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ECONOMIC GEOGRAPHY

VOL. 29 JANUARY, 1953 No. 1

LAND FOR 2.4 BILLION NEIGHBORS*

George B. Cressey

Dr. Cressey, Maxwell Professor of Geography at Syracuse University, was President of the International Geographical Union from 1949 to 1952.

EACH of us has nearly two and a half billion neighbors. Every hour the total increases by 3000; each day by 70,000 people. By the end of the century the world's population may approach four billion. Where can these people live and in what comfort? Each year adds about one per cent. In the history of the earth few figures are more dramatic than this increase of population. In three centuries the numbers of mankind have increased fivefold; from 470 million in 1650 to 2,400 million in 1950 (Table I).

Geography is concerned with people; it is equally concerned with land. Where is our good land, how much do we have, and how much more remains unused? For the earth as a whole there are some 42 people per square mile, but in terms of arable land the figure rises to 500. It is mmediately obvious that some areas are better than others. One square mile of Manhattan Island supports a daytime population of a million people, and they are among the most prosperous on earth. But the entire population of a million square miles in Siberia or the Sahara numbers only a few thousand. The world differs enormously in its agricultural potential, in its mineral resources, and in the desirability of its locations.

Geographers are interested in population but so are demographers; we are concerned with food but agriculturalists have the last word. No one else is more competent to evaluate the totality of land. This includes all of its environmental characters. Land is not an absolute, since soil may be depleted and climate fluctuates, but it is more of a constant than food production with its new seeds and techniques, or man with his changing standards. The function of the geographer is to locate and evaluate land of various qualities; what man does with it is another matter. Geography cannot set an absolute limit to population, but it can inventory our resources.

PRESENT LAND USE

The best data on present world land use are those of the Food and Agricultural Organization, presented in its annual Yearbook. These figures are based on information supplied by 158 political units, with estimates for other areas. This gives a world total of "arable land including fallow, plus orchards" (in French: "terres labourables et vergers"), as 1,230,000,000 hectares. This amounts to 4,747,000 square miles, or 8 per cent of the land surface. No

*Presented before the Seventeenth International Geographical Congress, Washington, August 13, 1952.

TABLE I

WORLD POPULATION GROWTH*

(000,000 omitted)

Area	*1650*	*1750*	*1850*	*1950*
Africa	100	100	100	199
Anglo America	1	1	26	166
Latin America	7	10	33	162
Asia	257	437	656	1,272
Europe with U.S.S.R.	103	144	274	594
Oceania	2	2	2	13
World Total	470	694	1,094	2,406

*United Nations, *Population Bulletin*, No. 1, Dec. 1951; data from Willcox, Carr-Saunders, and U.N. sources.

data are supplied for the area actually plowed and harvested in any one year, but allowing for orchards, fallow, and crop failure the cultivated area proper may be but two-thirds of this figure. Pasture and meadows cover 2,187,000,000 hectares, or 15 per cent. In per capita terms, these figures provide but 1.3 and 2.4 acres respectively (Table II).

Lautensach believes that 18 per cent of the land is cultivated, which seems quite high, 29 per cent is in forest, 21 per cent is steppe, and 25 per cent is wasteland (Table III).

For the area actually cultivated in comparison with that merely arable, we may turn to the 1941–46 Yearbook of the former International Institute of Agriculture, which gives a total, without the Soviet Union, of 1,621,879 square miles. To this may be added 583,152 square miles for the U.S.S.R., or a world total of 2,205,031 square miles. This is equal to 4 per cent of the continents.

Another figure is that of Pearson and Harper who report a total food crop area of 1,529,000,000 acres, 2,390,000 square miles, or 4 per cent (Table IV).

AGRICULTURAL LIMITATIONS

In order to evaluate land use potentials, let us look at limitations in terms of climate, soil, natural vegetation, and land form. All of these are variables in time and space. No place has too much light or warmth, but some have too little. Only fortunate areas always have the proper rainfall. Soil is more than mere dirt, and it is not a constant. Some lands are too dry, some have too short a growing season, some are too steep, some are too infertile. Too much of the earth is too limited by nature.

In terms of climatic regions, Thornthwaite[1] finds that areas of permanent

[1] C. Warren Thornthwaite: "The Climates of the Earth," *Geogr. Rev.*, Vol. 23, 1933, p. 438.

TABLE II

WORLD LAND USE*

(in hectares; 000,000 omitted)

Continent	*Total Area*	*Arable Land (incl. fallow and orchards)*	*Permanent Pasture and Meadows*	*Forest and Woodlands*	*Unused but Potentially Productive*[a]	*Built on and Wasteland*
Africa	3,042	187	579	918	80	1,278
Asia	2,684	346	257	472	92	1,517
Europe	493	147	96	128	10	112
Oceania	856	19	368	76	12	381
North America	2,428	241	421	764	107	895
South America	1,779	64	343	746	66	560
U.S.S.R.	2,227	225	124	920	12	946
Total	13,509[b]	1,230 (2,838 acres)	2,187 (5,402 acres)	4,024 (9,139 acres)	379 (936 acres)	5,689 (14,052 acres)

*Food and Agricultural Organization, Yearbook, 1950, Table I.

[a] Incomplete data. World totals may be twice this figure.

[b] This total omits Antarctica; including Antarctica the total land area of the earth is 59,407,786 square miles, or 38,020,983,000 acres.

TABLE III

WORLD LAND USE*

Continent	*Square Kilometers*	*Kulturland*	*Wald (Forest)*	*Steppe*	*Odland (Waste)*
Africa	29,800,000	18%	32%	32%	18%
Antarctica	14,200,000	0%	0%	0%	100%
Asia	44,200,000	21%	29%	21%	29%
Australia	9,000,000	11%	14%	38%	37%
Europe	10,000,000	44%	30%	6%	20%
North America	24,000,000	15%	37%	17%	31%
South America	17,800,000	21%	45%	23%	11%

*Hermann Lautensach: "Landerkunde," Gotha: Justus Perthes, 1926, p. 14.

frost, tundra, and boreal forest occupy 16,881,000 square miles. Almost all of this is too cold for crops. Desert and steppe account for 16,996,000 square miles, which is largely too dry. Each of these covers 30 per cent of the land area, with no overlap. Some possibilities do exist for crops or grazing in these areas; but the total is very limited. Not all of the remaining 40 per cent is usable due to steep slopes, infertile soils, or poor drainage. Some areas are too wet, others are so hot that evaporation is excessive. On the basis of Thornthwaite's map, at least 60 per cent of the continents appear climatically unsuited for agricultural use. Another climatic estimate is supplied by Pearson and Harper, who report that in terms of adequate and reliable rainfall and suitable temperature, 68 per cent of the land area is not adapted to food production.

The world wide extent of various soil types is given by Praslov.[2] Desert, mountain, and tundra soils, plus permanent snow and ice, take up 48 per cent of the continents. These areas have virtually no food producing value. Chernozems and grassland soils, gray and brown forest soils, and alluvium occupy 24 per cent, and for the most part are available for agriculture, although rainfall is locally precarious and topography is not always favorable. This leaves 28 per cent in a marginal category; podzolic soils in cold areas of short summer, or red and lateritic soils in hot, tropical areas. While each of these has agricultural possibility, its fertility is low. Passably good land in cold or hot areas is more than counterbalanced by inferior patches within otherwise usable areas. On Praslov's data and for the continents as a whole, poor soils eliminate at least half of the land from significant food production, with another quarter of debatable value. Pearson and Harper find 52 per cent of the land unavailable due to soil restrictions.

In terms of natural vegetation as it relates to crop land, H. L. Shantz finds that the extent of vegetation types in cool areas theoretically adapted to food production amounts to 11,778,000 square miles. Similar warm weather vegetation areas amount to 12,730,000, a total of 24,508,000 square miles or 43 per cent of the total land surface. This implies that 57 per cent of the land is probably unavailable for agriculture (Table V).

The usability of land for crops or pasture is further restricted by land form. Spectacular terracing reaches into the hills of the Orient, but only at the cost of excessive human labor. The tragic result of soil erosion on even gentle slope lands in the United States is a warning of the danger of plowing

[2] L. I. Praslov: *Pedology* (Moscow) #2, 1946, pp. 69–76; quoted in *Chronica Botanica*, Vol. 11, 1947–48, p. 232.

slopes that are subject to rapid erosion. Mere altitude is not a barrier except as it affects climate. Although most of the earth is mapped as to elevation, we have no proper maps of land *form*. Here is one of the major needs in geography. About a quarter of the earth is mountainous or hilly. Plateaus cover a third, but include many level areas. Plains occupy two-fifths, but this includes snow surfaces in Antarctica, rolling deserts in many continents, and other areas climatically impractical for cultivation. Allowing for level or rolling land in each category, Pearson and Harper estimate that 36 per cent of the land surface has topography unfavorable for agriculture.

Geography is concerned with land in all its qualities. Whether man uses this land wisely is his reponsibility. The engineer may reclaim the desert, if we wish to pay the price. Land which appears marginal or undesirable in one economy may prove usable under another. Geography per se can set no limits on maximum areas of land use, but it can properly inventory and evaluate the physical base. No statistics as to the ultimate extent of crop land or food supply can be absolute. Each generation must answer its own problems.

Available Arable Land

Figures for the total of so-called arable land still unused vary widely. They also depend on estimates as to minimum requirements of frost-free days, rainfall, or soil fertility. A new variety of wheat which would mature in, for example, 80 days would extend the cultivable area many miles poleward; while wheat which would grow with 10 inches of rain would push cultivation into the deserts. Unfortunately, localities with these conditions have weather which fluctuates widely from year to year. Crop failures are chronic.

The 1950 Yearbook of the Food and Agricultural Organization includes "unused but potentially productive" land (in French: "susceptible d'utilisation"). Data have been supplied by only 57 political units and no attempt has been made to fill in figures elsewhere. China, Australia, and important areas in Africa are omitted, nor are the figures compiled on any comparable basis. This preliminary total amounts to 379,000,000 hectares (1,500,000 square miles). If

TABLE IV

WORLD LAND USE*

(in acres; 000,000 omitted)

		Food Crops						*Adapted to Agricultural Production*	
Continent	*Total area*	*Area*	*Per cent*	*Land with adequate rainfall*	*Land with sufficient warmth*	*Land with favorable topography*	*Area of good soil*	*Area*	*Per cent*
Africa	7,300	152	2	1,800	7,300	5,700	4,700	240	3
Antarctica	3,400	.....	..	.....	.....	800	.....	.....	..
Asia	10,400	476	5	3,000	9,400	5,800	4,900	600	6
Europe	2,400	477	20	1,900	2,300	1,500	1,900	890	37
Oceania	2,100	24	1	200	2,100	1,800	1,400	60	3
North America	5,500	317	6	2,100	3,900	3,900	2,200	570	10
South America	4,600	83	2	3,200	4,500	3,200	1,200	220	5
World	35,700	1,529	4	12,200	29,500	22,700	16,300	2,580	7

*Frank A. Pearson and Floyd A. Harper: "The World's Hunger," Ithaca, 1945, Tables 12, 13, 15, 17, 18, 20.

TABLE V

NATURAL VEGETATION AND LAND USE*

(in square miles; 000 omitted)

	Area	Grazing land	Cropland		Total
			Cool Weather	Warm Weather	
FOREST					
Tropical rain forest	3,800	.....	.....	3,800	3,800
Temperate rain forest	500	.....	550	.....	550
Deciduous forest	6,500	.....	6,440	60	6,500
Coniferous forest	7,600	1,000	40	30	70
Dry forest	2,000	2,000	.....	2,000	2,000
Thorn forest	330	.....	.....	.....	.....
Sclerophyl Brushland	1,178	.....	1,178	.....	1,178
Total	21,958	3,000	8,208	5,890	14,098
GRASSLANDS					
High grass savanna	2,800	2,800	.....	2,800	2,800
Tall grass savanna	3,900	3,900	.....	3,900	3,900
Tall grass	1,580	1,580	1,580	.....	1,580
Short grass	1,200	1,200	1,200	.....	1,200
Desert grass savanna	2,300	2,300	.....	140	140
Mountain grassland	790	790	790	.....	790
Total	12,570	12,570	3,570	6,840	10,410
DESERT					
Desert shrub and desert grass	10,600	10,600	.....	.....	.....
Desert	2,400	.....	.....	.....	.....
Salt desert shrub	30	15	.....	.....	.....
Tundra	4,400	.....	.....	.....	.....
Total	17,430	10,615	.....	.....	.....
GRAND TOTAL	51,958	26,185	11,778	12,730	24,508

*H. L. Shantz: Agricultural Regions of Africa, Part III, *Econ. Geog.*, Vol. 18, 1942, pp. 360–61.

data were supplied by all countries, this total might be doubled. The limited value of these estimates as to potentials is indicated by the variation between Canada, 83,652,000 hectares, and the Soviet Union which reports but 12,000,000 hectares undeveloped. Brazil and the French Cameroons list 29,296,000 and 64,000,000 hectares respectively.

O. E. Baker[3] takes the area of tropical and subtropical lands as 23,000,000 square miles, of which he estimates that 8,000,000 are too arid for use. Of the remaining 15,000,000 with suitable rainfall, Baker assumes that about one-third might some day be usable. Cultivated land now amounts to 1,200,000 and pasture 600,000 square miles. This leaves 3,200,000 square miles as "potentially arable, not used for crops or pasture" in warm lands. In the temperate zones, Baker finds a land area of 29,000,000 square miles of which 7,600,000 are too dry and 6,400,000 square miles are too cold. This leaves 15,000,000 square miles with satisfactory growing season and rainfall. Again, assuming that one-third ought to be usable, and deducting the 2,500,000 now cultivated and the 1,500,000 square miles now in pasture, Baker believes that 1,000,000 square miles are potentially available for crops or pasture. This gives a world total of 4,200,000 square miles, or 2,688,000,000 acres, of now unused agricultural land. Obviously, such figures are meaningful only in terms of his one-third assumption.

Another estimate has been made by Robert M. Salter.[4] He uses Praslov's

[3] O. E. Baker: "Land Utilization in the United States," *Geogr. Rev.*, Vol. 13, 1923, p. 25. See also his "The Population Prospect in Relation to the World's Agricultural Resources," *Journ. of Geogr.*, Vol. 46, 1947, pp. 203–220.

[4] Robert M. Salter: "World Soil and Fertilizer Resources in Relation to Food Needs," *Chronica Botanica*, Vol. 11, 1947–48, pp. 227–235; also in *Science*, Vol. 105, 1947, pp. 533–38.

TABLE VI
ESTIMATES OF UNDEVELOPED LAND

1. Food and Agricultural Organization (incomplete)	936,000,000 acres
2. Pearson and Harper	1,070,000,000 acres
3. Robert M. Salter	1,300,000,000 acres
4. O. E. Baker	2,688,000,000 acres
5. Carl Alsberg	2,560,000,000 to 2,880,000,000 acres
6. L. Dudley Stamp	6-7,000,000,000 acres
7. Charles B. Fawcett	7,801,000,000 acres

areas for soils, cited above, and concludes that there may be available for cultivation 900,000,000 acres in Africa and South America, and an additional 100,000,000 acres in Madagascar, Sumatra, Borneo, and New Guinea. This is a total of some 1,000,000,000 acres or 1,500,000 square miles, in the tropical red soil areas. An additional 300,000,000 acres or 500,000 square miles, may be developed in the cool podzol areas. These totals are a third of Baker's figures.

Charles B. Fawcett[5] believes that areas too dry for agriculture total 40 per cent, while those too cold and hilly account for 30 per cent. This leaves 30 per cent of the land surfaces as potentially arable, some 17,000,000 square miles. From this is to be subtracted 108,000,000 hectares which Fawcett states are now arable, leaving 7,801,000 acres still available.

The most specific analysis of the land possibilities is that of Pearson and Harper. On the basis of map studies, they find that 17 per cent of the land is too cold, 66 per cent too dry, 36 per cent too steep, and 54 per cent too infertile. Allowing for overlaps, the remaining area suitable for cultivation is thought to cover 7 per cent of the land. This is actually less than the 8 per cent shown as now arable by the Food and Agricultural Organization.

A further figure is that of Carl Alsberg,[6] who states that there are 5.5 to 6 million square miles now cultivated or in pasture, and a total of 10 million which would be used if necessary. This would leave 2,560 to 2,880 million acres still available. L. Dudley Stamp[7] believes that cultivable land totals 10 billion acres, of which 3 to 4 billion are now in use. Just where this unused land may be, or what its characteristics are, few of the above writers indicate.

These estimates of undeveloped land, not now used for crops, are summarized in Table VI. Since figures for land already cultivated range from 1.5 to 2.8 billion acres, these estimates suggest a maximum tripling of crop area. Yields and costs are another matter.

Undeveloped land unquestionably exists in many parts of the world; it is the extent and quality which is in dispute. Abandoned hillsides in the northeastern United States might again be cultivated, but the economic return would be small. It might be possible to increase the present 370 million acres of crop land to 450 million if costs were not important. Heath land in Britain could be cleared and plowed. Once-cultivated fields outside the Great Wall of China which were abandoned because of drought might be reused with better machinery and dry farming techniques. The Amazon and Congo may some day produce large crops, but soils are so infertile that expensive enrichment will be necessary. Java is the one equatorial area where food has become available for a dense population. This illustrates the difference between the continental

[5] Charles B. Fawcett: "The Extent of the Cultivable Land," *Geogr. Journ.*, Vol. 76, 1930, pp. 504–09.

[6] Carl Alsberg in "Limits of Lands Settlement," Council of Foreign Relations, New York, 1937, pp. 42–43.

[7] L. Dudley Stamp: "Land for Tomorrow," Bloomington, Ind., 1952, p. 54.

and maritime tropics. There will never be another Columbus; pioneers can never again find good land free for the asking.

There are few limits to the maximum area which may be cultivated, given labor and capital. Even parts of the tundra may grow specialized vegetables, and some of the desert has a limited agricultural potential. None of these are now attractive in terms of costs or returns. The problem of maximum land use is one of agricultural techniques and of economics. Geographers can only inventory and evaluate the resources. Land of marginal quality will remain inferior in yields. Handicaps of cold and of drought, and of sterile soils, will continue to hold back pioneer settlement on the frontiers.

There will always be a pioneer fringe, but it seems probable that the major increase of food will come within existing farm areas. Improved seeds and more efficient methods will produce larger yields in the more advantageous areas. This is noticeably true within the Soviet Union, where most of the area brought into production since the Revolution has been within the established agricultural triangle rather than on its fringes. It is quite proper that we examine pioneering possibilities, but there is more unexploited pay dirt in Illinois than Wyoming, or in Honan than in Kansu, or in France than in Finland.

Our expanding population will certainly call for more food. The easiest source is through increased yields on existing farm land. It is doubtful whether much food can soon or economically come from new land. Agricultural Australia has about reached its limit. Homesteading has essentially ended in the United States. The Peace River Country of Canada offers little more attractive farm land. Siberia has nearly plowed its last virgin prairie. Irrigation projects in the dry parts of the Soviet Union are ambitious but questionable.

If the Amazon and Congo or the Arctic have crop potentials of large extent, their exploitation lies well in the future. Meanwhile erosion and soil exhaustion result in the abandonment of impressive acreages.

Marginal land cannot compete with more favorable areas. Photographs of erosion in the loess country of China are tragic scenes from a moving picture of land abandonment. So too are views in the American Piedmont. Despite the pressure for food the world around, the United States is abandoning land about as fast as it is adding to it.

Until we conquer the arctic and the tropics, it is quite possible that the world is near the peak of total cultivated acreage. We may have already passed it. World population increases at the rate of one per cent a year, or more. Cultivated acreage is or may soon be on the decline. This need not mean diminished food, for we may secure greater yields through more intensive development of our better land. The point is this: if more food is needed, and that is obvious, geography cannot offer new land of much value. The good earth is essentially all in use, and the major map boundaries of cultivated land have become stabilized. This must be emphasized, for there are no longer empty areas worth developing. Idle land does exist, but it is of very unattractive quality. If added millions are to be fed, the geographer has no new Iowa or Murray Valley or Siberian steppe. The map cannot be stretched much more.

On the other hand, some competent geographers take a different point of view and write of "millions of square miles of potential farm land," and state that "There is then, for the present,

ample room in the world; and there is no purely *areal* reason why every man should not have enough land and to spare on which to feed himself and his family."[8] All would agree, however, that the first requisite is to find the facts. One should not confuse space with opportunity.[9]

This study was initiated in the hope that it might be possible to draw precise maps; first, of existing crop land; and second, of potential areas; each with appropriate gradations and evaluation. That this is impractical is due not so much to the absence of surveys as to the inherent nature of land itself. We may map a farm and measure its wheat fields, but what we call a wheat field is only partly occupied by wheat, half the ground is bare. Furthermore, some fields yield two or three times as much per acre as others even nearby. Land as a resource is not a matter of square miles, it is qualitative and relative. We surely need comprehensive surveys and maps, but critical estimates as to potentials must await better data than are now available. Every time we measure land, we need a fresh yardstick to fit the changing requirements of man's technology.

FOOD POSSIBILITIES

There have been many estimates as to future food supply—some pessimistic, others glowingly optimistic. At one moment, we are alarmed by Malthusian possibilities; the next day we are assured that food from the sea or through new fertilizers will provide nourishment for all. Whereas Malthus predicted an unequal race between a rabbit (population) and a tortoise (food), the contest proceeds neck and neck. The rabbit shows no signs of slowing down and the turtle is a mechanical marvel which can run as fast as necessary to keep pace.

How much food can our land supply under reasonable improvements? At the moment, half of the world's population lives in a permanent state of hunger.[10] Salter estimates that, if all present crop land were brought up to possible yields, in general 20 per cent above present returns, the world could meet most of its food needs by 1960. This would eliminate famine and malnutrition. The cost in money and organization would be large. In addition, if there are a billion acres of potential farm land in the tropics which prove usable and could be developed to yield at the Philippine average, and if there are 300 million acres of cool soils possibly available for crops which could be cultivated to produce at Finnish levels, then the world might more than double its output of cereals, triple its supply of fruits and vegetables, and increase its meat supplies by half (Table VII).

The world's population now exceeds 2.4 billion. Estimates as to the maximum population which the earth might support depend on the standard of living and many other unpredictables. Salter's figures of maximum food supply indicate a possible doubling of our population. Fawcett suggests three times the present, say 6 or 7 billion. Albert Penck once proposed 13.5 billion. Kuczynski believes that more than 11 billion is impossible. "The maximum population . . . can, of course, only be attained with the freest possible migration. The United States . . . would have to accept her due share of the 10 or 11 billions, say 800,000,000."[11]

[8] George H. T. Kimble: "The World's Open Spaces," London, 1939, pp. 28 and 62.

[9] W. D. Forsyth: "The Myth of the Open Spaces," Melbourne, 1942.

[10] Josué de Castro: "The Geography of Hunger," Boston, 1952.

[11] Robert Kuczynski: "Population" in "Harris Foundation Lectures," Chicago, 1930, pp. 285–6.

TABLE VII

POTENTIAL FOOD PRODUCTION*

(annual yield in metric tons; 000,000 omitted)

	Cereals	*Sugar*	*Fats and Oils*	*Fruit and Vegetables*	*Meat*
Pre-war production	300.4	30.0	15.2	156.3	65.6
Possible increase	20%	15%	20%	35%	20%
Attainable increase on present cropland	360	34.5	18	211	78.7
Attainable increase on present cropland plus one billion acres of tropical soils on Philippine standards	717	177.5	69.5	470	89.4
Attainable increase on present cropland plus 300 million acres of cool soils on Finnish standards	395	35.1	19.4	No Finnish data	86.1
Total attainable production	753	178.1	70.9	470	96.8
World food needs in 1960	363	33.6	204	411	95.8

*Robert M. Salter: "World Soil and Fertilizer Resources in Relation to Food Needs," *Science*, Vol. 105, 1947, pp. 533–38.

A more conservative estimate is that of Pearson and Harper. Since grains supply about three-fourths of man's diet, they estimate that if everyone lived on Asiatic standards of living, the present world production might support nearly three billion people. If all the world had European food standards, we would have only enough food for our present population, while on American standards of living and the present total food supply, the population which could be supported would be less than a billion, or 40 per cent of the present total. Pearson and Harper also estimate that 4 per cent of the land is now cultivated, and only 7 per cent capable of crop production. The additional 3 per cent is of marginal value, and its capacity to support added population is limited.

On the basis of geographic evidence, it seems probable to the author that our food potential is adequate for all the population likely to inhabit the earth during the present century. Unfortunately, the areas where production can be increased do not correspond with the present areas of excess people. Unlimited migration and a free movement of food are essential if the expected population is to be fed. It is doubtful whether we shall soon cultivate the Amazon and Congo basins or northern Canada and Siberia; but if we do, the crowded areas of China, India, and Europe will demand access to this food.

What does all this mean to a geographer? Variations in land capability are obvious. Unfortunately, we do not yet know what all the earth is like. We have no world inventory of land or its potentials. Soil surveys are incomplete, so are data on agricultural climatology. We do not even know how much of the earth is level. In fact, large areas are without basic maps. Geographers are concerned with inventory, with how much of what is where. This is the beginning of all wise planning. Before anyone can predict the potential extent of arable land, or of food supply, or of world population, we must greatly extend our fundamental knowledge of land itself.

Man has lived on the earth for a long time, and we have learned much. But we have been living off the cream with little appreciation of what comes next. Peace and normal living require economic well-being, and this requires a wise understanding of our resources. To all this, geography offers an essential preface.

THE REFUGEE PROBLEM OF GERMANY

Chauncy D. Harris and Gabriele Wülker

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VAST waves of population displacement engulfed the peoples of Europe as a consequence of World War II. According to Malcolm J. Proudfoot about 60 million Europeans were involuntarily moved from their homes either during the war or in the postwar period. Germany was the center of movement in both periods and the continued presence of more than 14 million refugees in Germany today constitutes a critical contemporary national and international problem.

Types of Refugees in Germany

There are four principal groups of refugees in Germany: displaced persons, expellees, political refugees from the Soviet zone, and neo-refugees from abroad (Table I). Except for the expellees, distributed throughout the four zones, the refugees are found only in the German Federal Republic (American, British, and French zones) and not in the German Democratic Republic (Soviet zone). In this paper western Germany will be used synonymously with the German Federal Republic, Germany with the present four zones and Berlin, and prewar Germany as the country within the boundaries of 1937.

Displaced persons (DPs) are non-German laborers brought to Germany from other countries during the war; the eight million DPs formed the largest and best-known group of persons removed during the war. Most such laborers were returned to their homes immediately after the end of the war but about one million persons within western Germany either could not or did not wish to return to their former home areas, mostly east of the Iron Curtain in Poland, the Baltic states, and the Ukraine. This remnant received aid originally from Military Government, then from UNRRA, and later from IRO (International Refugee Organization); most of them have been resettled, partly in Israel but mostly in the English-speaking countries of the United States, Australia, Canada, and Great Britain. By October, 1951, only about 200,000 of them still remained in western Germany, of whom 33,800 were in IRO camps and presumably would be largely resettled overseas; the others probably will remain for the most part as permanent residents of Germany. On February 14, 1950, the Allied High Commission placed under German care many of the DPs formerly cared for by the IRO, and on February 28, 1951, the Bundestag gave those DPs who were to remain in western Germany equal civil rights with the Germans. For the most part the remaining DPs

TABLE I

ESTIMATED REFUGEE POPULATION IN GERMANY

(In thousands, 1950)

	Germany (4 Zones and Berlin) (Estimate)	*German Federal Republic Sept. 13, 1950 (Census)*	*German Democratic Republic (Estimate)*	*Berlin (Estimate)*
Total Population	68,800	47,696	17,800	3,300
Expellees	12,448	7,876[a]	4,442	130
Reichsdeutsche	7,374	4,469	2,805[b]	100[b]
Volksdeutsche	5,074	3,407	1,637[b]	30[b]
Refugees from Soviet Zone and Berlin	1,555	1,555		
Displaced persons	249	249		
Neo-refugees	200	200		

Sources: German Federal Republic, Statistisches Bundesamt, Wiesbaden: "Statistische Unterlagen zum Flüchtlingsproblem 10. Folge, 2. Lieferung, *Statistische Berichte*, Arbeit No. VIII/20/4. January 21, 1952. (Mimeographed.) Tables II.6 and II.1.

Europäische Forschungsgruppe für Flüchtlingsfragen: Mitteilungen No. 2, Munich, November 15, 1951.

International Refugee Organization: Statistical Report, July–September 1950. Geneva, 1950.

[a] The number of expellees with Flüchtlingsausweisen (cards certifying refugee status) was 7,946,513. Expellee figures in table are based on place of residence on September 1, 1939, outside the four zones of Germany and Berlin.

[b] Division among Reichsdeutsche and Volksdeutsche in German Democratic Republic and Berlin is made on assumption that the ratio was same in 1950 as in the 1946 census.

are not eligible for emigration; they represent the so-called hard core of people who are old, sick, or otherwise difficult to resettle.

The expellees numbering about 12½ millions form by far the largest block of peoples in Europe uprooted after the war. They are similar to the DPs in that they too could not return to their homes, mostly in the East. But outside Germany, they have received far less attention than the DPs. Expellees are German-speaking people who were expelled from their homes. There are two main groups: (1) Reichsdeutsche, or German citizens, who formerly lived in that part of prewar Germany which lay east of the Oder-Neisse line. (2) Volksdeutsche, or ethnic Germans, who formerly lived in other countries, in which they formed minority groups. Reichsdeutsche had always been citizens of Germany, but Volksdeutsche, though retaining German culture and language, had been citizens of non-German countries. The ancestors of Reichsdeutsche in former German territory and of Volksdeutsche in Czechoslovakia (so-called Sudetendeutsche) had lived in these areas for many centuries, often since the original settlement. Volksdeutsche in Hungary, Yugoslavia, and Romania, the so-called Swabians, were mostly resettled into these areas from southwestern Germany in the 18th century in frontier settlements established to guard against the Turks.

A large group of German political refugees have fled from the Soviet zone of Germany to the western zones. Their number had reached 1.5 millions by 1950. In 1950, 245,000 migrated from the Soviet zone into western Germany compared to a movement of 32,000 in the reverse direction.

A new group of political refugees, sometimes called neo-refugees, similar to the DPs in being non-German, totals about 200,000. This postwar stream is filtering into western-Germany through the Iron Curtain from Czechoslovakia,

Poland, and Hungary, in part en route to Israel.

The problem of caring for the expellees and other refugees in Germany was complicated, particularly at the outset, by the presence of evacuees. Evacuees are mostly aged persons or women or children who left the cities and industrial areas during the war, either because of air-raids or because of actual destruction of homes. At the end of the war they numbered about 10 millions, but by 1951 all but about one million had returned to their home areas, if not to their actual former homes. Part of the remaining evacuees now feel at home in their new surroundings and will doubtless remain there, but many will wish to return to their old homes.

This article is concerned principally with the largest group of present refugees, the expellees, and only incidentally with DPs, with German refugees from the Soviet zone, or with non-German neo-refugees. The discussion of the origin and distribution of expellees will consider the whole of present Germany but the treatment of food, housing, and work problems and of governmental measures will be limited to the area of the German Federal Republic.

ORIGIN OF THE EXPELLEE MOVEMENT

The expulsion of the German expellees from eastern Germany and other lands, apparently the largest mass expulsion in European history, was another expression of the excessive and cruel nationalism which caused widespread suffering and loss of life during the war. In article 13 of the Potsdam Agreement of August 2, 1945, the Soviet Union, Great Britain, and the United States recognized (reflecting the previous Yalta agreement) "that the transfer to Germany of German populations, or elements thereof, remaining in Poland, Czechoslovakia, and Hungary, will have to be undertaken." On November 20, 1945, the Allied Control Council in Berlin set up plans for the transfer of 6.65 million expellees to Germany. The number of expellees, however, totalled nearly twice as many, or 12.5 millions. By the time of the Census of October 29, 1946, there were already 9.6 million expellees in Germany. The increase of nearly 3 million since that census includes returning prisoners of war whose former homes had been in the areas of expulsion, later expellees retained for a time for technical skills or other reasons, some expellees who had been evacuated to Denmark and were still there during the 1946 census, and the natural increase in population of the expellee group.

Of the 12½ million expellees now in Germany about 7½ millions are Reichsdeutsche who came from former parts of Germany and about 5 millions are Volksdeutsche from other countries.

The source of Reichsdeutsche, that part of former Germany east of the Oder-Neisse line, had a 1939 population of 10 million persons and an area of 44,240 square miles, one-fourth of prewar Germany. This area included East Prussia, most of Silesia, most of Pomerania, and part of Brandenburg (Table II), all of which had been integral parts of Germany for many centuries.

The expulsion of Reichsdeutsche from this former German territory was carried out by Poland and the Soviet Union, partly under the thesis that Poland should receive land in the west to make up for land in the east lost by Poland to the Soviet Union in 1939. The northern half of East Prussia was annexed to the Soviet Union and the southern half of East Prussia and the parts of Pomerania, Brandenburg, and

TABLE II

SOURCE OF EXPELLEES

Province or Country	*German Federal Republic Census of September 13, 1950*	*Soviet Zone Census of October 29, 1946*[b]
Reichsdeutsche	4,469,460	2,274,000
East Prussia	1,347,203	.....
Silesia	2,053,414	.....
Pomerania	891,078	.....
Brandenburg	131,163	.....
Saar[a]	46,602	.....
Volksdeutsche	3,406,751	1,327,000
Czechoslovakia	1,912,000	841,000
Poland	409,654	246,000
Hungary	177,817	.....
Danzig	224,812	.....
Romania	148,596	57,000
Yugoslavia	147,494	.....
U. S. S. R.	51,235	57,000
Baltic states	59,440	.....
Memel	47,740	.....
Other Europe	206,628	.....
Overseas	21,335	.....
Not specified	.....	126,000

Sources: German Federal Republic, Statistisches Bundesamt, Wiesbaden: *op. cit.*, Tables II.3, II.6.

Friedrich Edding, Hans-Erich Hornschu, and Hilde Wander: Das deutsche Flüchtlingsproblem, p. 5.

[a] Germans in the Saar were not expelled but the census definition of Reichsdeutsche includes all German citizens living in present Germany but living on September 1, 1939, outside the four zones and Berlin but within German boundaries of 1937.

[b] It is estimated that these figures increased by about 23 per cent between 1946 and 1950 (cf. Table 1), but actual 1950 figures are not available.

Silesia to Poland, although these annexations have not been recognized by the Western powers. About 10 per cent of this area was annexed by the Soviet Union and 90 per cent is administered by Poland.

Volksdeutsche were mostly expelled by governments attempting to solve difficult minority problems by the complete and immediate elimination at the end of the war of the German minorities within their boundaries. It should be noted, however, that some Volksdeutsche (about 250,000) had been brought to Germany during the war by governmental agreements between Germany on the one hand and Italy and the Soviet Union on the other, as in the cases of the removal of German minorities from the Tirol in Italy or from areas then being incorporated into the Soviet Union—the Baltic states, Bessarabia, Bukovina, and Volhynia. The expulsion of Volksdeutsche did not involve changes in political boundaries.

The two principal sources of Volksdeutsche have been Czechoslovakia and Poland (Table II); in both of these countries there were large minorities of ethnic Germans in the boundaries set up after World War I.

Nearly 3 million expellees came from Czechoslovakia, which before the war had about 3.5 million ethnic Germans, or Sudetendeutsche, who formed a relatively solid population in the mountain borderlands of the republic.

About 0.7 million Volksdeutsche expellees came from Poland. Several hundred thousand more ethnic Germans resettled in Poland during World War II from the Baltic countries, Romania, Yugoslavia, South Tirol, and the Black Sea area of the Soviet Union are commonly counted under these areas, although at the end of the war they actually were removed from Poland.

Volksdeutsche expellees have come out of many lands of Central and Southeastern Europe (Table II). The expulsion of the ethnic Germans in Hungary was mentioned in the Potsdam Agreement but the 0.2 million expellees from Hungary fell far short of the anticipated 0.5 million. Expellees from other countries were not considered by the Potsdam Agreement (except insofar as they had been resettled in Poland during World War II), but Danzig was the source of 0.2 million, Romania 0.2 million, the Soviet Union of 0.1 million, Yugoslavia of 0.15 million, and the Baltic countries, Memel, Bulgaria, and Italy (South Tirol) of smaller numbers. Also about 0.2 million Germans were sent back to Germany from western Europe and overseas countries.

DISTRIBUTION OF EXPELLEES

The expellees are very unevenly distributed in Germany. In 1950 expellees made up about 18 per cent of the total population of Germany but the proportion varied from 25 per cent in the Soviet zone, 18 per cent in the American zone, and 17 per cent in the British zone, to only 7 per cent in the French zone (Table III). In 1950 Mecklenburg, in the Soviet zone, with 47 per cent of its population made up of expellees, was the most serious problem area. In many parts of Mecklenburg the proportion of expellees in the population exceeded 50 per cent (Fig. 1); that is, expellees outnumbered the native population. In most parts of the Soviet zone expellees exceeded 20 per cent of population. Schleswig-Holstein, in which expellees made up 33 per cent of the population, is the most serious problem area in the territory now included in the German Federal Republic. Lower Saxony with 27 per cent and Bavaria with 21 per cent make up the other two of the three chief problem areas in western Germany. (The names and boundaries of the present German states are shown on Figure 2.)

The uneven distribution of expellees reflects five major factors: (1) distance from the eastern boundary of Germany, (2) location with respect to the Baltic Sea, (3) legal restrictions in the French zone, (4) housing availability in rural areas, and (5) lack of coordination in early days.

(1) A glance at Figure 1 shows that the area of highest concentration is the eastern part of Germany near the boundary of Czechoslovakia and the

TABLE III

REFUGEE POPULATION IN GERMANY BY STATES

State	*Total Population*	*Expellees*	*%*	*Other Refugees*	*%*
German Federal Republic (Census of Sept. 13, 1950)	47,695,672	7,876,211	16.5	1,555,075	3.3
British Zone	24,193,809	4,156,355	17.2	949,889	3.9
Schleswig-Holstein	2,594,648	856,943	33.0	133,918	5.2
Hamburg	1,605,606	115,981	7.2	67,655	4.2
Lower Saxony	6,797,379	1,851,472	27.2	369,425	5.4
North Rhine-Westphalia	13,196,176	1,331,959	10.1	378,891	2.9
American Zone	17,916,278	3,347,626	18.1	506,835	2.8
Bremen	558,619	48,183	8.6	21,398	3.8
Hesse	4,323,801	720,583	16.7	165,686	3.8
Württemberg-Baden	3,907,848	649,597	16.6	94,319	2.4
Bavaria	9,126,010	1,929,263	21.1	225,432	2.5
French Zone	5,585,585	372,230	6.7	98,351	1.8
Rhineland-Palatinate	3,004,752	152,267	5.1	46,476	1.5
Baden	1,338,629	98,375	7.3	28,299	2.1
Württemberg-Hohenzollern including Lindau	1,242,204	121,588	9.8	23,576	1.9
German Democratic Republic (Soviet Zone) (Estimates)	17,800,000	4,442,318	25.0		
Saxony	5,800,000	988,743	17.1		
Saxony-Anhalt	4,300,000	1,062,285	24.8		
Thuringia	2,900,000	681,014	23.0		
Brandenburg	2,700,000	723,157	27.0		
Mecklenburg	2,100,000	987,119	46.5		
Berlin	3,300,000	130,000	3.9		

Sources: German Federal Republic, Statistisches Bundesamt, Wiesbaden: *op. cit.*, Tables II.1 and II.2.
Europäische Forschungsgruppe für Flüchtlingsfragen: Mitteilungen No. 2, Munich, November 15, 1951.

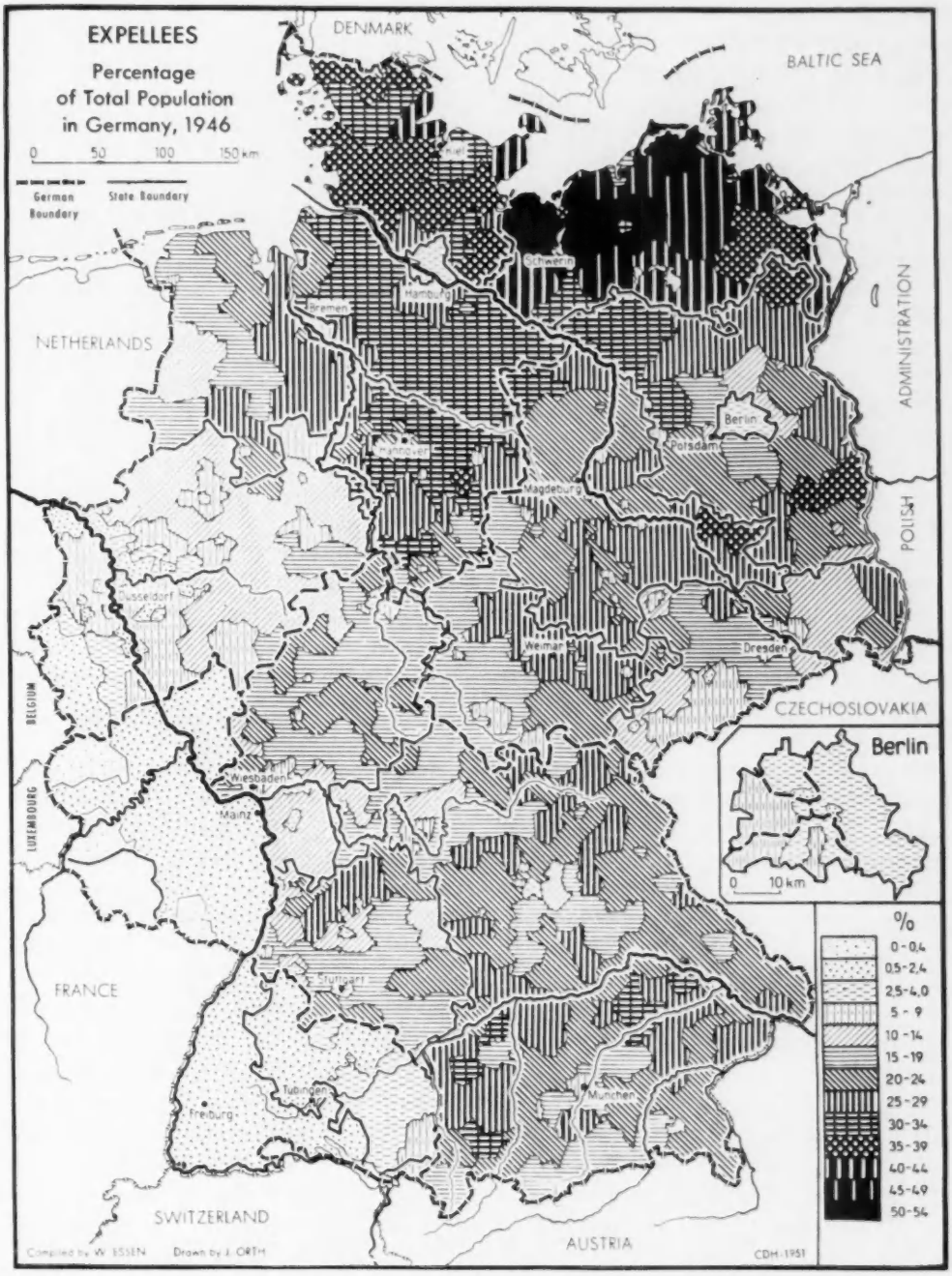

FIG. 1. Expellee Percentage of Total Population of Germany, Census of October 29, 1946. (Reproduced by permission of Werner Essen and the Institut für Raumforschung, Bonn, from Das deutsche Flüchtlingsproblem, Sonderheft der Zeitschrift für Raumforschung, p. 11.)

western limit of Polish administration. As the expellees moved or were moved westward, many did not get far beyond the nearest border. One can speak of the major area of concentration in the east, either northeast of a line from the western tip of Czechoslovakia to the North Sea west of Bremen or of Bavaria in the southeast.

(2) The expellees from East Prussia moved westward along the Baltic Sea and piled up in large concentrations in both Mecklenburg and Schleswig-Holstein on the southern coast of that sea and near the Danish border.

(3) The French zone in 1946 had very few expellees (only 1.9 per cent of the population) since France had not been a party to the Potsdam Agreement and on November 20, 1945, had agreed to a maximum of 0.15 million expellees from Austria only under strong pressure. In effect the borders of the French zone were closed (until 1948) to all refugees except those who entered specifically to join relatives or to accept previously arranged employment.

(4) The mass destruction of urban housing during the war accounts for the predominantly rural distribution of refugees. According to the 1946 census 85 per cent of the expellees in Bizonia (United States and British zones) were in rural areas (compared to 61 per cent of the native population). At the time of the 1950 census 70 per cent of expellees in the German Federal Republic were still living in rural communities with less than 5000 inhabitants.

The areas of lightest concentration of expellees, aside from the French zone, are in the Ruhr industrial district of North Rhine–Westphalia and in the commercial city-states of Bremen and Hamburg, where wartime destruction of nearly half the housing units resulted in an acute shortage of living space.

At the end of the war Germany was a land of destroyed cities and overcrowded villages. Between 1939 and 1946 the present area of Germany gained in population by 5.2 millions but the 46 cities of more than 100,000 population in 1946 had declined in population in this period by 3.7 millions, or nearly 20 per cent. In contrast the communities with less than 20,000 inhabitants (both urban and rural) increased in population by 8.8 millions or nearly 30 per cent. The urban-rural ratio, which before the war had been rising rapidly, dropped back to the level of 1870. The 1946 census was taken on October 29, 1946, a year and a half after the end of the war, so that temporary evacuees from the cities had had time to return to the cities, if they could find any livable space there.

(5) Part of the unequal distribution of expellees must be attributed to the lack of coordination. The expellees were handled initially on a local basis within each state. For four years there was no central German government, since the occupation forces initially prohibited any governmental organization at higher than local levels. The American zone early attempted to equalize the burden among the various states (Länder) within this zone. The British and American zones were joined into Bizonia in 1948. Trizonia was formed by the addition of the French zone in 1949. A responsible elected federal German Government for these three zones was first established in 1949 (German Federal Republic) but up to the present time the Soviet zone has remained separate with its own government (German Democratic Republic).

The population of Germany at the time of the 1950 census (in 1950 boundaries) was about the same as in the prewar 1939 census (within boundaries of 1937). The 1950 population was about 69 millions compared to 69.5

millions in 1939. The influx of Volksdeutsche expellees from outside the former boundaries of Germany (5 millions) plus the natural increase in population nearly balanced the war losses.

This same population is crowded into a much smaller area. Within the boundaries of present Germany there were only 58.8 million people in 1939. The 17 per cent increase in population in this area is accounted for entirely by the movement of 12.5 million expellees into the area from beyond the present limits of Germany. The areas of expellee concentration are the areas with the largest population growth 1939–1946 (Fig. 2).

As a result of boundary changes and the movement of the expellees, the average density of population for Germany as a country jumped from 380 per square mile in 1939 to about 500 in 1950. The density of population within the area of present Germany, however, increased only from 435 to about 500, since the density of population in the areas east of the Oder-Neisse line was only 218 per square mile in 1939. Germany now is one of the most densely settled countries of the Western world. In Europe only Belgium, the Netherlands, and the United Kingdom have higher densities. Germany has nearly three times the population density of France. There now are virtually no rural areas in Germany, no matter how poor the soil, with densities below 130 persons per square mile, or 2½ times the average density in Iowa.

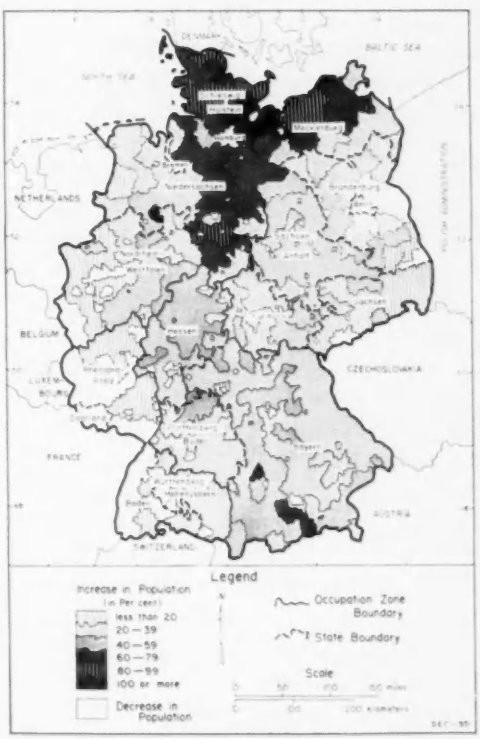

FIG. 2. Percentage Increase in Population in Germany, 1939–1946. (Redrawn with permission of Hilde Wander and Institut für Weltwirtschaft an der Universität Kiel from Friedrich Eddings, Hans-Erich Hornschu and Hilde Wander: Das deutsche Flüchtlingsproblem Appendix Fig. 1.)

The integration and assimilation of this flood of expellees poses many difficult and complex problems. The expellees will have to be integrated into the German society and economy as there is little hope either of return to their former homelands or of emigration. Only the problems of economic integration will be considered in this article. The discussion will be limited to the area of the German Federal Republic, which contains 7.9 million expellees; lack of comparable data or information on plans precludes a similar discussion for the German Democratic Republic with an estimated 4.4 million expellees, or Berlin with 0.1 million.

In this area the expellees face three major economic problems: food, housing, and work.

FOOD PROBLEMS

Initially the expellees suffered from shortage of food. With the establishment of better welfare procedures, however, their food problems have become an undifferentiated part of the general

German food problem. The food problem of western Germany however was aggravated by the expellee-caused increase of population without any corresponding increase in agricultural land or food supply.

The food problem of Germany is serious. The area east of the Oder-Neisse produced about 25 per cent of the food grain of Germany before the war. That area not only fed its own population (14 per cent of the then total for Germany) but also produced a considerable food surplus which moved westward into other parts of Germany. As a result of the loss of this major agricultural area and the movement of its population as expellees into present Germany, western Germany now imports about 45 per cent of its food in comparison with 20 per cent (for all Germany) before the war.

In order to obtain adequate food for its population, Germany needs both to increase domestic agricultural production and to develop industrial exports with which to pay for food imports.

The chances of greatly increasing domestic agricultural production are not promising, although with application of fertilizers and other capital expenditures prewar levels of production were surpassed in western Germany by 5 per cent in 1951. Germany has had an intensive agriculture for decades and the best resources are intensively used already. Further developments will be expensive and not very productive.

Western Germany, becoming more and more like Great Britain in the structure of its economy and in dependence on imported food, faces similar problems in the production of exports with which to pay for food. Since these exports will need to be largely manufactured goods, Britain and the United States present keen competition in the world markets. The virtual severance of trade with southeastern and eastern Europe because of the establishment of the Iron Curtain has hurt western Germany particularly, inasmuch as those areas formerly exported food to Germany in exchange for German industrial goods.

HOUSING PROBLEMS

The number of persons per room in Germany is now much higher than before the war. The causes of this increase are (1) the loss of about 20 per cent of all housing units through wartime air raids or other war actions (and the damaging of an additional 20 per cent), (2) the increase in population in western Germany by about 21 per cent through the arrival of expellees, and (3) the requisitioning of housing for occupation forces. The density of housing in western Germany according to the 1950 census was 1.17 persons per room, a much lower figure than pre-census estimates anticipated. The *maximum* legal space per person that any family may occupy (regardless of ownership or past occupance) is only about half the *average* space per person in the United States. Any family having more space has had to take in additional persons. Thus many dwellings originally intended for one family are lodging two or three. These often unwelcome "guests" frequently establish an independent heating and cooking system with a minimum of capital expenditure. Furthermore, much space formerly considered unsuitable for human habitation must now be lived in.

It will be difficult to fill even the most pressing housing needs in the near future. Although 1950 and 1951 were two years of active construction, there was still a shortage of 2.5 million dwelling units in western Germany at the beginning of 1952. (The number of dwelling units now is about 10 million.)

The expellees fare much worse in housing than the native population. An extreme case of housing density differentials occurred in the village of Gedern in Kreis Büdingen in Hesse; here the density of natives on November 1, 1947 was 1.52 persons per room, of evacuees 2.27, and of expellees 4.52. In Schleswig-Holstein in 1949, 60 per cent of the expellee families still lived in no more than a single room per family and only 8 per cent of the expellee families had a private kitchen. In Bavaria in 1950 only 13 per cent of the expellees were living in decent and adequate quarters. On July 1, 1951, 324,112, or 4 per cent of the refugees in the German Federal Republic, were still living in mass quarters or camps.

The present housing for expellees is in rural areas but work opportunities occur almost solely in the cities. This separation of housing and work is the direct cause of enormous unemployment and also of considerable time loss for those expellees who by commuting long distances are able to work. In the suddenness of arrival of the expellees little or no attention could be given to economic considerations. The first thought was to get the expellees under some sort of shelter. Available space was largely in rural farming districts, which, unlike urban and industrial districts, had escaped heavy wartime damage. These were the very districts in which employment opportunities were and are meager. This separation of housing and possible work has plagued all efforts to ameliorate the lot of the expellees.

In some cases the wage-earner in the family has simply left the family to move as a single individual to a substandard temporary abode nearer his place of work. He may return home week ends.

In other cases the workers commute daily. Astonishing tales are told of the amount of time spent in commuting, principally on bicycles or by train or both. In the hills near Frankfurt am Main one sees droves of bicycles as early as 5 a.m. with workers who live way up in the hills and who spend as much as several hours each day travelling to places of work in the cities on the Rhine-Main plain. In early morning or evening the railroad stations are jammed with workmen who travel distances up to a hundred miles daily. Large industrial firms in many areas have installed bus service either daily or merely weekly (to enable workers to get home week ends).

According to the 1950 census there were 3.2 million commuters in the German Federal Republic. The number of daily commuters into Frankfurt am Main (population just over 500,000) is currently estimated at 50,000 as compared with 38,000 before the war. Much but not all of the increase may be attributed to the expellees.

In contrast with typical situations in the United States, it is the more poorly paid workers who travel the farthest. The commuting is not from residential suburbs adjoining the great cities but from overcrowded agricultural villages far distant.

WORK PROBLEMS

Unemployment and underemployment problems afflict the expellees. At the time of the 1950 census 12.4 per cent of the expellee labor force was unemployed compared to 4.6 per cent of the native population. Although expellees constituted only 18 per cent of the labor force in the German Federal Republic, they accounted for 39 per cent of the unemployment at the time of the 1950 census.

Unemployment exhibits marked regional variation (Fig. 3). It is high in the northern and eastern sections of

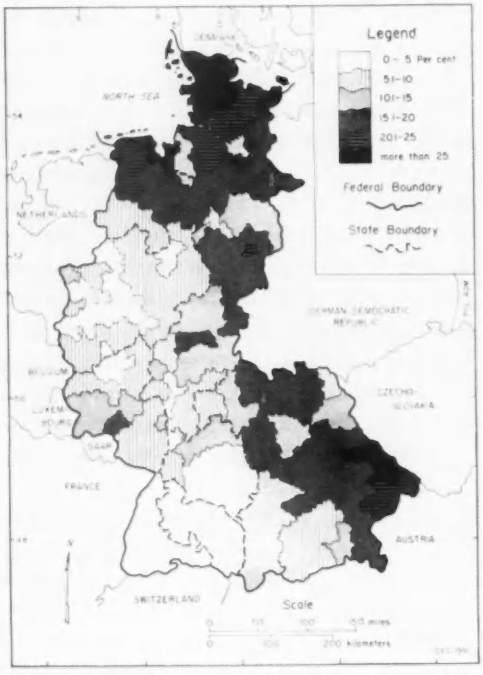

FIG. 3. Percentage of Labor Force Unemployed in German Federal Republic, June 30, 1950. (Based on a map prepared by German Federal Republic, Bundesminister für Arbeit, Statistik.)

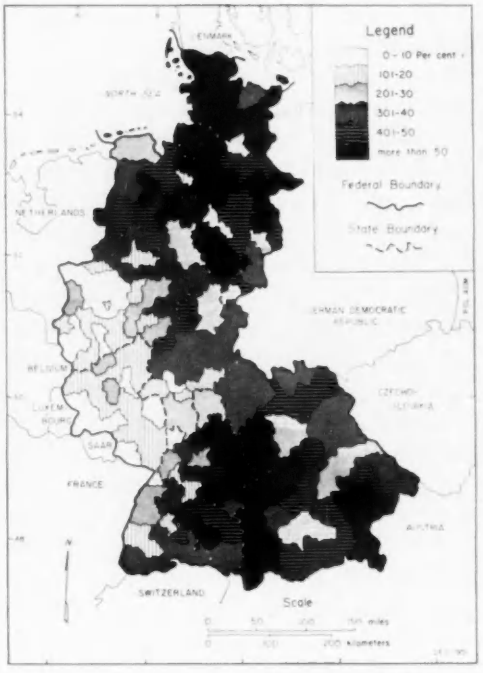

FIG. 4. Percentage of Unemployed Who Are Expellees, German Federal Republic, June 30, 1950. (Based on a map prepared by German Federal Republic, Bundeminister für Arbeit, Statistik.)

the German Federal Republic; these are the areas in which the expellees are concentrated. In March, 1952, 22 per cent of the labor force in Schleswig-Holstein was unemployed and 51 per cent of this unemployment was among expellees. Furthermore, the proportion of total unemployment accounted for by expellees is high in the areas of expellee concentration (Fig. 4). The areal distribution of unemployment in Germany stands in sharp contrast to the cyclical depression unemployment of industrialized lands, since unemployment in cities or industrial regions is negligible but in rural areas, staggering. Thus unemployment represents a structural and areal problem in western Germany, not solved by the general economic improvement since 1950. The explanation of this pattern of unemployment lies in the enormous increase in the rural population as a result of the settlement of expellees almost solely in rural areas already overpopulated, and in the location of work opportunities in the cities and industrial areas, where housing is not available.

One of the key problems is whether to attempt a solution of the depressed areas problem by bringing industries to these areas or by moving the surplus population to centers of potential employment. Although much controversy centers on this point, in general it is felt that factory industries may be more successful in present industrial and urban centers (where housing would have to be built for any expellees brought in), but that some handicraft industries can be developed in the areas of present rural expellee concentration. A further consideration is that employment opportunities can be developed more rap-

idly by the expansion of present industrial centers than by the creation of new industrial points.

The bringing of the unemployed expellees into productive work constitutes a major challenge to the government of the German Federal Republic. Their integration into economic life will require enormous amounts of capital. As a result of wartime destruction of capital within the present area of western Germany and the inability of the expellees to bring their capital with them (in the form of farms, factories, houses, equipment, and investments), there is a dearth of capital available for investment in activities that would employ the expellees.

A mixed American and German ECA Technical Assistance Commission on the Integration of the Refugees in the German Republic, under the chairmanship of H. Christian Sonne, made a study of the problem and recommended that 12.5 billion DM be spent over the next six years in an attempt to integrate 605,000 unemployed expellee workers in agricultural and industrial production (150,000 in agriculture, 160,000 in handicrafts and trade, and 295,000 in industry). It is estimated that about 3.6 million refugees have found some type of employment, although many are not yet in types of work for which they are qualified by training or experience.

Great difficulties obstruct the effective utilization and integration of expellee farmers, estimated in western Germany at 294,000 formerly independent farmers and many more former farm laborers. Only a fraction of these can ever succeed in resettling on farms of their own, or even in working on farms at all. Long before the arrival of the expellees there was a shortage of agricultural land in western Germany. In this area 80 per cent of all farms have less than 10 hectares (about 25 acres) of land. The average size of farm is less than 7 hectares (17 acres), or less than half the average size of farms in France or Denmark. Because of the shortage of farmland and very low agricultural wages, a strong rural-urban migration has characterized the past several decades.

There are three potential sources of farm land for the expellee: (1) division of large estates (the so-called Landreform), (2) transfer to expellees of titles to existing farms, and (3) reclamation of waste land.

It is reported that the division of large estates was carried through rigorously in the Soviet zone (German Democratic Republic). Here the characteristic large estates were subdivided into small farms, reported to be 7 hectares in size regardless of the quality of the land or the location of the farm with respect to transportation and markets. It is further reported that in this zone 80,000 expellees and 120,000 natives were resettled. Within western Germany there were fewer large agricultural estates and there has been no such vigorous program for the division of such estates as did exist. Some states have carried through land reforms, but the principal beneficiaries have been the land-hungry native farmers rather than the landless expellees.

In 1949 a law on resettlement of expellee farmers (Flüchtlingssiedlungsgesetz) provided that farms without heirs or farms not currently worked should be made available to expellees either for ownership or renting.

The reclamation and cultivation of waste land offers some promise in a few areas. Germany, however, has been intensively cultivated for centuries and there remains little additional good land that could be cultivated profitably. The Emsland, a poorly drained area

along the Ems River near the German-Dutch border, offers some possibilities if sufficient capital can be found.

Altogether by January, 1952, a total of 23,000 farms were operated by refugees, about 60 per cent of them as owners, the rest as tenants. Only half of these farms, however, were large enough to support a family; the others were part-time farms.

The difficulties and limited possibilities of finding farms is revealed by the modest hopes of ECA Technical Assistance Commission. It proposed that 100,000 farms providing work for 150,000 persons should be made available to expellees in the next six years at a cost of 2.75 billion DM. But of these farms, nearly two-thirds (65,550) would be merely part-time farms averaging only 1 to 1.5 hectares, on which farm work would be done by women and children and from which men and grown children would commute to work in cities. Furthermore, land already in cultivation would be expected to provide 87,000 of the farms: 39,000 by dividing large farms and 49,000 by transfer of titles to existing farms under the law of resettlement of expellee farmers. Only 13,000 farms would be based on newly reclaimed land.

The majority of the unemployed expellees probably will have to find work in industry in cities, where there currently are employment opportunities but no housing. It is estimated that as rapidly as capital can be found for construction of urban housing 150,000 expellees can find work there.

Of lesser total importance but of great interest are the industries established by the expellees themselves. The expellees have set up industries similar to those in which they worked before the war in other lands: textiles, clothing, chemicals, metals, glassware, ceramics, electrical and optical goods, musical instruments, toys, jewelry, leather goods, and wooden goods. The enterprises are oriented toward consumer goods and are relatively small. About 7 per cent of the industrial enterprises of western Germany are estimated to be operated by expellees. Expellee industries are especially important in Bavaria, to which expellees came principally from the Sudetenland of Czechoslovakia and Silesia—both industrial areas. It is said that the Sudeten Germans accounted for 40 per cent of the exports of Czechoslovakia before the war. By April 1, 1951, some 2391 concerns had been established by expellees in Bavaria, employing 63,000 persons. At Kaufbeuren-Neugablonz the buildings of former war-chemical plants were converted to provide work for 6000 of the Gablonz glass workers from the Sudetenland. North Rhine-Westphalia has also been an important area of refugee enterprises. Studies in the distribution of expellee enterprises in Bavaria indicate three important factors in success: cheap skilled labor (of expellees), rapid turnover (reflecting shortage of capital), and location at transport centers. In conformity with the last-mentioned factor, the enterprises generally are in cities and towns and not in the areas of eastern Bavaria, which have high unemployment. This applies to all Germany as well as to Bavaria.

Expellees have had the same difficulties (and successes) in handicraft work as in larger industrial concerns. According to a handicraft census taken in the autumn of 1949 some 37,813 handicraft enterprises, or 4.4 per cent of those in western Germany, were owned by expellees or other refugees; this is less than a fourth the number one would expect from the percentage of expellees in the total population.

FEDERAL GOVERNMENT MEASURES AND REDISTRIBUTION PLANS

The German Federal Republic, established in September, 1949, finally provided a responsible central government for western Germany. The government immediately created a Ministry for Expellees (Ministerium für Vertriebene). This ministry assumed responsibility for expellees on the Federal level as a supplement to the agencies of the states or local units.

Preliminary to the final Law on Equalization of Burdens (Lastenausgleich) for compensation of the expellees for war losses, immediate aid (Soforthilfe) was established on August 18, 1949. It extended aid and credit to the expellees, who previously had been cared for solely by the states and their political subdivisions.

The Law of Equalization of Burdens, which treats the entire problem of compensation for war losses by all groups, is the matter of much controversy among the various groups and the taxpayers. A capital levy of 50 per cent is to be declared on all property (of value over 5000 DM) of all types, whether agricultural, business, industrial, residential, forest, or of inventory of goods existing at the time of the currency reform (June 28, 1949). This levy is to be separated from all taxes and is to be collected over a period of 30 years. The proceeds are to be distributed to those suffering war losses: (1) expellees who lost property in the eastlands, (2) natives who suffered war losses to property, (3) persons who lost savings through the currency reform (but only if lacking other sources of income), or (4) political and racial persecutees. The expellees, conscious of their lack of capital, have demanded an immediate division of the property in western Germany to compensate them for war losses, estimated at 75 to 100 billion marks. The capital losses in former German territory east of the Oder-Neisse line may have amounted to 40–60 billion marks, in the Sudeten areas of Czechoslovakia 25–30 billion, and in other countries perhaps 10 billion.

The Ministry for Expellees established an expellee bank in the spring of 1950; this bank refinances the loans granted to refugees by local banks.

The government of the German Federal Republic has concerned itself also with areal redistribution of expellees. Such redistribution is urgently needed for many reasons, particularly to give better employment opportunities. Because the expellees were not distributed on the basis of economic considerations, the distribution of population and of carrying capacity are seriously out of balance. Several major distressed areas now exist.

In spite of many proposals for redistribution, little has been accomplished by official programs. By decrees of the government of the German Federal Republic on November 29, 1949, and May 22, 1950, plans were made to resettle first 300,000 and later an additional 600,000 refugees. Within the Federal Republic up to the end of 1950, however, only 160,000 persons had been resettled in groups and only 26,000 as individuals. The main fault with the official redistribution programs of 1949 and 1950 was the ignoring of economic considerations. Two-thirds of the persons resettled were directed to the French zone without providing the necessary jobs; consequently newcomers here continued to be unemployed and many of them later remigrated to places with employment possibilities, particularly the Ruhr area. Thus shortly after official transports had reached Rhineland-Palatinate (French zone) in

1950, migration thence to industrial centers rose sharply. The resettlement program for 1951 followed better principles in tending to direct refugees to industrial areas but lack of coordination with the housing program restricted the movement.

It was proposed by the ECA Technical Assistance Commission that an official resettlement program ought to move 700,000 refugees (260,000 workers and their families) from overcrowded areas to areas better able to support them. The carrying out of this plan depends, among other things, on the availability of adequate capital to build the necessary housing. It is significant, therefore, that the ECA Commission recommended that 7.9 billion DM be spent on housing for expellees during the next six years; this expenditure would constitute nearly two-thirds of all governmental investments toward integrating the expellees into German life. This housing should be constructed not in areas of present expellee concentration but in cities, where the expellees may hope for productive employment. Thus the construction of housing is a major key to the redistribution of expellees, to their economic integration in the German Federal Republic, and to the reduction of structural (regional) unemployment. But in a larger sense the future economic welfare of the expellees is an integral part of the general problem of the economic future of Germany.

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PACIFIC ISLAND AGRICULTURE: THE CONTEMPORARY POSITION IN WESTERN SAMOA AND SOME WIDER IMPLICATIONS

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THE postwar boom in agricultural prices for tropical products has not been accompanied by uniform effects in the various island groups of the South Pacific Ocean. While agricultural maladies are apparent and obvious in the Cook Islands, the prosperity of native-commercial and plantation agriculture in Fiji and Western Samoa is in striking contrast.[1]

Within the extensive field of economic development, postwar programs in the Pacific Ocean area have been directed towards the increased productivity of the islands and the extension of the, hitherto, narrow agricultural base of the insular economies. During the last 20 years greater attention has been focussed on Western Samoa where, among the native people, there is a growing national consciousness, and an increasing impatience with existing social, political, and economic inequalities. Western Samoa has been exposed to European civilization for barely 100 years and Samoan society, socially and to a limited extent economically, has been able to absorb and modify the external influences to which it has been subject.[2] Politically, however, the disruptive forces have not been so readily overcome. In part this is a legacy of the international intrigue of the latter half of the nineteenth century which accentuated the internal jealousy already present amongst the Samoan leaders. With the ousting of German control during the 1914–1918 war and the accession of New Zealand as the mandatory power, native political consciousness increased and found an organized outlet in the *Mau* movement between 1927 and 1936. By concord between the administrative authority and the *Mau* leaders, political representation for the Samoans was advanced. Since the conclusion of the war in the Pacific in 1945, New Zealand, by accepting the terms of trusteeship for Western Samoa, has fully committed herself to promote the development of the territory towards self-government. Towards this ultimate aim progress has proceeded apace.[3]

The rapid political developments cannot be divorced entirely from the basic factors of land, resources, people, and trade. The fundamental basis of the

[1] See Kenneth B. Cumberland: "New Zealand's 'Pacific Island Neighbourhood': The Postwar Agricultural Prospect," *N.Z. Geographer*, Vol. 5, 1949, pp. 1–18; W. B. Johnston: "The Citrus Industry of the Cook Islands," *N.Z. Geographer*, Vol. 7, 1951, pp. 121–138.

[2] See F. J. H. Grattan: *An Introduction to Samoan Custom*, Apia, Western Samoa, 1948.

[3] The position is reviewed by J. W. Davidson: "Political Development in Western Samoa," *Pacific Affairs*, Vol. 21, 1948, pp. 136–149.

welfare of the 72,800 Samoans is the conservative but productive cultivation of numerous tropical crops. This remains a vital feature for a progressive standard of living and must be considered essential to successful advancement whether it be social, political or economic.

THE PHYSICAL ENVIRONMENT

Western Samoa consists primarily of the two large islands of Savai'i and Upolu which comprise 99 per cent of the land area (Fig. 1). The total area is only 1130 square miles, approximately one-third of the area of the Hawaiian

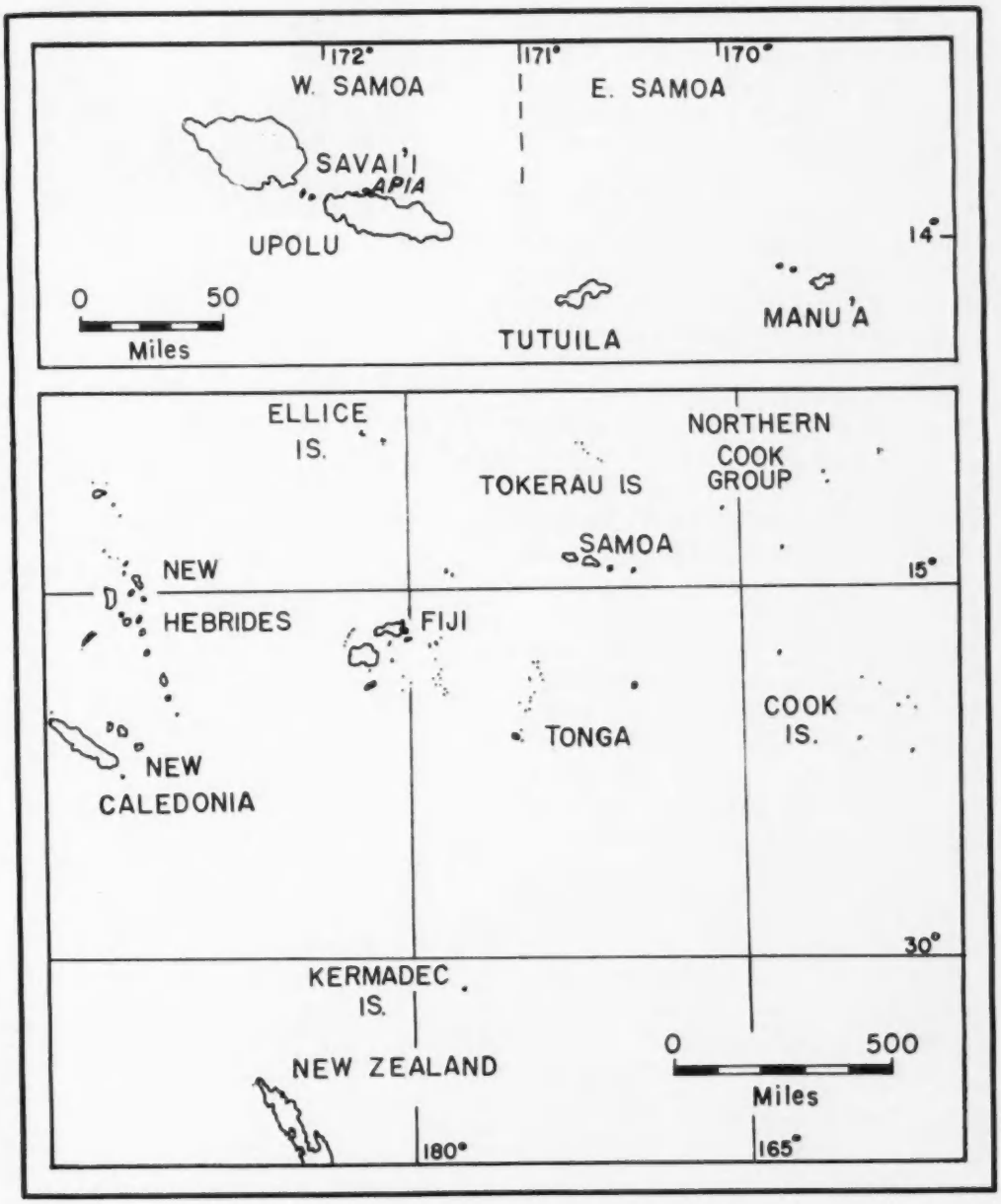

FIG. 1. Samoa and its place in the South Pacific.

Islands. Upolu, the smaller of the two principal islands, is economically supreme. Further it is the commercial and administrative center for the group. Physiographically the islands are volcanic or "high" islands with an axial range of peaks which extends in an east-west trend and which lies close to the southern coast. The rugged mountainous core rises over 3500 feet on Upolu and over 6000 feet on Savai'i. Radiating from the central mountains are numerous dissected ridges which in northeast Upolu reach the coast in steep cliffs separated by low-lying coastal flats. In the northwest of Upolu the slopes are more gentle and have been only incipiently dissected by the numerous streams. It is in this northwest segment that the majority of the plantations have been established. Savai'i suffered volcanism between 1905 and 1911 when extensive areas of cultivated land were covered by lava flows.

Climatically, Western Samoa is tropical with superhumid macrothermal characteristics (Fig. 2). The high humidity and the intense nature of precipitation are occasionally accentuated by severe tropical cyclonic storms especially during the moister summer season from November to March. The islands, which extend between latitudes 13° and 15° south, are not within the regular hurricane tracks. Although the southeast trades are dominant there is a tendency for the trade winds to follow the direction of the coast. Near the western end of the north coast of Upolu the percentage of northeasterlies is much greater than at Apia and exceeds the percentage of easterlies in some months. Precipitation is heavy but varies considerably with altitude and southerly or northerly location. While at Apia the dry and wet seasons are pronounced, stations on the south coast show only a slight

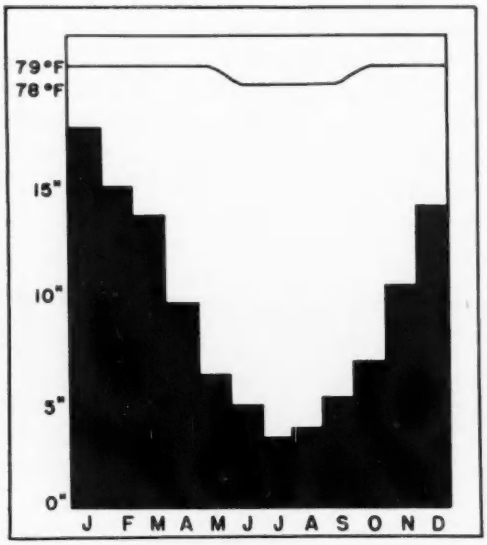

FIG. 2. Climatic Graph for Apia (1890–1943): 13° 48′ S., 171° 47′ W. Altitude 6½ feet. (Source: New Zealand Meteorological Office.)

decrease during the months from June to September.

The character of the vegetation reflects the superhumid climate and is essentially tropical rainforest. The pattern is comparatively simple, the variations being related primarily to altitudinal changes and exposure. The respective altitudinal bands extend lower on the more exposed and moister southern coast, and range from mangrove associations at tidal levels through diverse rainforest communities to more specialized species of restricted number at higher elevations. On Upolu the pattern extends to the watershed divides, but in Savai'i the highest ridges are dominated by moss forest and scrub.

The soils developed under these climatic and vegetative conditions are lateritic.[4] They are characteristically red and brown clay loams but vary in their fertility. On extensive lowland areas they have been cropped for successive

[4] See W. M. Hamilton and L. I. Grange: "The Soils and Agriculture of Western Samoa," *N.Z. Journal of Science & Technology*, Vol. 19, 1938, pp. 593–624.

generations by native methods, yet they still maintain a high degree of fertility. A significant attribute is the rocky nature of their texture; the numerous blocks of lava on the surface and scattered throughout the subsoil preclude intensive tillage of the soil without the expenditure of large sums of money and considerable energy. This agricultural impediment varies from areas where the rough fragments are only slightly weathered, to others where the weathered material has a depth of several feet.

THE DECLINE OF PLANTATION AGRICULTURE

Commercial agriculture is concentrated on the production of three tree crops—cacao, coconuts, and bananas (Fig. 3). These constitute over 90 per cent of the exports and form the chief source of revenue (Fig. 8). Although production is primarily in native hands, there is some specialization in cacao on European plantations. Banana growing is virtually a native monopoly while approximately 85 per cent of the copra is dried from native crops. On the other hand cacao production is shared between European and natives with the former of slightly greater significance.

Agriculture is dominant on the coastal lowlands especially in the northwest sector of Upolu. The recent improvements in road communications have opened new land in the southwest and marginal to the trans-island road. The latter area is now important in banana production. The major European plantations are those of the New Zealand Reparation Estates which formerly belonged to German nationals or companies. In 1949 they included an area of more than 75,000 acres of which only one-fifth was under cultivation or leased to individual planters. The remainder was unimproved forested land and classified as unfavorable for agricultural development. During that year the Reparation Estates produced 14 per cent of the cacao, 6 per cent of the copra, and 100 per cent of the dessicated coconut that was exported. The economic establishment of the dessicated coconut factory, as the one important processor of agricultural products in Western Samoa, is the outcome of the most successful experiment during the last decade. Proposals have been formulated to erect a second factory. The primary processes of husking, washing, peeling, and rewashing of the coconuts provide popular employment for local labor. Power for the disintegrating drying and grading machines is supplied, in part, by steam plants which burn the coconut husks and, in part, by diesel motors generating electricity. The manufactured product has been successfully marketed in New Zealand although a few shipments have been sent to Australia. The postwar experiment of a dried-banana industry proved unprofitable and failed to establish a regular market.

The Reparation Estates operate as a trading concern but remain the property of the New Zealand Government. The profits have been largely returned to Samoan advantage in the form of educational, medical, and other developmental programs. Moreover, the increasing pressure on the land has occasioned, since 1920, the return to Samoan holdings of almost 40,000 acres formerly the property of the Reparation Estates. Further the Samoan Government is at present negotiating with the Reparation Estates for 42,000 acres of unimproved land.

Plantation methods of agriculture, as witnessed by the Reparation Estates, are now definitely on the decline. This trend has been partially resisted by individual European planters, but it is

FIG. 3. A typical Samoan village scene. Copra and cocoa drying indicate commercial crops; pawpaw tree and fishing net the subsistence aspect. (Photo from New Zealand National Publicity Studios.)

FIG. 4. The ribbon pattern of coastal native settlement against a background of the broad sweep of coconut-studded coastal lowlands. The jetties built out from the shore of the lagoon are the unhygienic native form of latrines. (Photo from New Zealand National Publicity Studios.)

becoming increasingly apparent that greater responsibility for agricultural production in addition to political affairs is passing into Samoan control.

EXPANSION OF NATIVE AGRICULTURE

The cultivation of export crops by Samoans is intimately associated with the communal village and tribal lands. With the rising prices for tropical products there has been an extension of native agriculture. This expansion is also an indirect reflection of rapid political developments; further, and possibly of greater significance, it points to the increased pressure of population upon the available resources. Although the Samoan is now more dependent, than before the war, on bully beef, ships' biscuits, sugar, tinned foods, and similar store commodities, he has been forced, by population pressure, to extend the area of land under subsistence crops. In order to satisfy the rapidly growing demand for food, cultivations have spread onto the thinner soils of the steeper slopes which are, at the same time, farther away from the coastal villages. Moreover, within the shifting method of cultivation which is dominant, the subsistence farmer is obliged to reuse formerly cultivated areas after a shorter period of rest. The increased rotation of land restricts the recuperation period to only five to eight years instead of the former 20 to 30 years.

One of the major problems allied to the increased demands now made on the land is that of soil exhaustion. Various attempts have been made by the Department of Agriculture to solve this mounting problem. The greatest prospects appear to lie in the use of dadap (*Erythrina*), a leguminous cover crop which helps to compensate for the shorter period of non-cultivation. More extensive use is now being made of dadap by interplanting in banana areas and also in cacao plantations.

On the other hand, fixation of the shifting cultivations has occurred in many areas. The very high profits returned for cacao have encouraged widespread planting of cacao trees. This expansion has not only removed large areas from the rotation cycle but has limited further the potential area available for subsistence crops. Within this new trend there is discernible a more or less regular system of cultivation and in the agricultural neighborhood of the commercial focus of Apia the pattern is particularly characteristic. Here it is areally important because the concentration of people on the land is greatest and the commercial incentive more powerful.

The first stage involves the felling—and in some instances burning—of the primitive or secondary forest. Amongst the tangled mesh of fallen logs, jagged stumps and profuse weeds, food crops—taro, ta'amu, cassava, yams—are planted. As the new areas are frequently distant from the coastal villages, a temporary *fale*, the native dwelling, is constructed, and here the grower lives for several days of the week while working on the family cultivation (Fig. 5). After the initial season of subsistence cropping, banana shoots are planted to provide a commercial harvest (Fig. 6). On formerly unused land they bear profitably for five or six years while on a re-used area the longest period is normally three years. Towards the end of the life of the banana trees, cacao is planted, so that after three years the first harvest of cacao pods will replace bananas as the principal source of income (Fig. 7). Cacao trees bear abundantly for 30 to 40 years; hence this system of agriculture removes the land from the shifting method of cultivation and involves the devotion of

land to long-term commercial crops at the expense of basic food supplies. Increased production of native food by crop rotation has not balanced this loss.

The present aim of the Samoan grower appears to be the production of as great a volume of commercial crops as possible, although this necessitates a decline in the quality of the product and the abandonment of the traditional, conservative methods of land use. Rarely are bananas planted at the recommended distance of 16 feet apart. Moreover, the removal of excessive shoots is neglected in the attempt to satisfy the popular demand for a maximum harvest and the maximum financial return. All too frequently the Banana Inspectors of the Department of Agriculture report these adverse features of contemporary native methods. Even when neglect lowers the financial return—for instance the failure to spray the bunches of bananas with insecticide to prevent scab moth—the native is slow to profit by expert advice. In the native cacao plantings abundant witness of illogical methods is apparent in the form of many moribund trees that have even failed to mature. Frequently this is due to carelessness in the initial stages of planting, for as the roots penetrate deeper they are impeded and confined by the rocky nature of the soil which deprives the growing tree of sufficient food nutrients.

FIG. 5. A new clearing in secondary forest with a temporary *fale* and food crops.

FIG. 6. Young banana plantings amongst standing coconut trees and fallen rotting dadap and undergrowth.

FIG. 7. The fixation of shifting native cultivations with cacao trees. The clean-weeded surface assists soil erosion whilst interplanted bananas emphasize the native desire to reap the greatest financial return even at the expense of soil fertility.

The rapid expansion of the area in cacao carries with it the distinct possibility of overproduction when the new plantings come into full production within the relatively short period of three to four years. However, the native grower visualizes only the continuation of the present price levels, and, with this assumption, he fully intends to capitalize on them as he becomes increasingly involved in the vortex of a full-scale commercial economy. The extension work of the Department of Agriculture has been only partially successful despite the commendable efforts of its officers. The threat of greater economic dependence on a commercial crop such as cacao, which is

subject to violent price fluctuations on the unrestricted world markets, does not portend economic security for a native group seeking self-government.[5] Diversity of agricultural production in tropical lands has always been a major need in order to combat the characteristic market changes. At the present time a degree of stability pertains to the copra industry in the recent contract with the United Kingdom. By this agreement the United Kingdom absorbs the total copra production at a price to be fixed annually in relation to that ruling in the previous year. The contract operates until 1957. At the same time the Samoan Copra Board has established a stabilization fund to assist further in times of depressed world prices.

EXTERNAL TRADE

The exports of Western Samoa are essentially of agricultural origin and are, primarily, copra and cacao, with bananas as a relatively minor source of external revenue. The recent rise in the value of cacao and copra exports, and in total exports, is a reflection of manner in which the islands have capitalized on the postwar boom in agricultural prices for tropical products (Fig. 8). At the same time there has been a substantial increase in the export quantities. The ten year period 1939–1949 witnessed a rise in the copra production of 35 per cent while the volume of cacao exported showed the phenomenal increase of 475 per cent.[6] The latter figure is for two extreme years but the general increase since pre-1939 days is still approximately 100 per cent. The reverse is evident in the banana trade in which the quantity exported fell by 55 per cent although the value of exports declined by only 15 per cent. Combined with the new cacao plantings the figures are significant as they emphasize the ultimate dependence of the

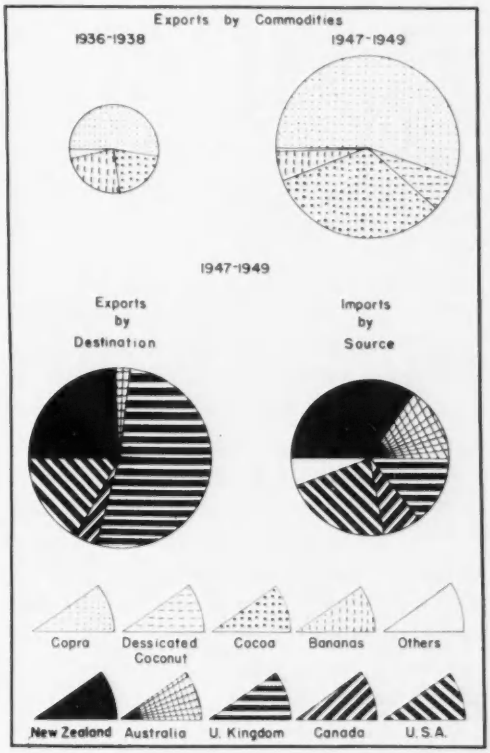

FIG. 8. The nature and direction of the export and import trade of Western Samoa. (Source: "Trade, Commerce and Shipping of the Territory of Western Samoa, 1950.")

islands' economy on two crops. The economy is rapidly becoming more restricted and specialized on sources of income which are extremely susceptible to marked price movements.

The markets for the agricultural exports are concentrated in the United Kingdom and the United States of America (Fig. 8). To the former goes the total copra production under the recent contract; both countries share in

[5] For a review of the world situation, the problem of disease, the structure of the industry, and, especially, the pertinent question of native-commercial and plantation systems of production, see H. A. Tempany: "The Threatened Future of Cocoa," *World Crops*, Vol. 1, 1949, pp. 10–14.

[6] All trade statistics are quoted from *Trade, Commerce and Shipping of the Territory of Western Samoa for the Calendar Year 1950*, Wellington, New Zealand, 1951.

the cacao exports. The third important market is in New Zealand which provides a stable demand for the banana crop. The favorable location of Western Samoa on important trans-Pacific Ocean routes is a significant factor in the distant marketing of her exports (Fig. 1).

The variety of Western Samoa's export markets is almost as wide as the sources of imports. New Zealand, United States of America, Australia, United Kingdom, and Canada are dominant (Fig. 8). By contrast with the export markets, a greater association with Australia and New Zealand, in the South Pacific area, is evident. During the years 1947 to 1949, inclusive, these two Dominions contributed, by value, 50 per cent of the imports. While the United States of America supplies approximately the same percentage of imports as she receives of exports, the United Kingdom is the source of less than one-fifth of the imports by value and yet she absorbs more than one half of the exports of Western Samoa. The nature of the imports is extremely varied, but the most important items include foodstuffs, drapery, apparel, and machinery.

Western Samoa fails to conform to the character of many tropical dependencies where external trade is concentrated with the administrative country. The predominance of New Zealand as the principal source for numerous vital foodstuffs—frozen and tinned meats, fresh vegetables, butter, and preserved milk—has frequently had undesirable repercussions.[7] A similar position exists in Fiji and the Cook Islands where the native people are, like the Samoans, becoming increasingly dependent on European foodstuffs. Moreover, the periods of stringency which result from the non-arrival of overseas food supplies bear vigorous witness to the neglect of native-subsistence agriculture, to the growing pressure of population, and to the impress of a modern commercial economy.

[7] This was vividly illustrated between February and July, 1951, when the waterfront crisis in New Zealand brought coastal and overseas shipping to a standstill. The supplies of foodstuffs, not only for the European residents but also for the natives of Western Samoa, were rapidly exhausted; the acute food shortage was only circumvented by special relief food ships from New Zealand. The position was at the same time critical in Fiji and the Cook Islands.

LAND, PEOPLE AND SETTLEMENT

Unlike the populations of Hawaii and Fiji, the present population of Western Samoa is dominantly Polynesian in character. The number of Europeans in the islands has decreased since the heyday of plantation agriculture and, latterly, with the greater employment of Samoans in clerical positions. After 1896, severe restrictions were imposed on the alienation of native lands. Further, Asiatic labor has been repatriated since the end of the indenture system in 1914. Both the labor problem and the non-alienation of native lands have decreased the incentives and opportunities for plantation agriculture.

The European element in the population is principally of New Zealand extraction and small in number. It is concentrated in the commercial and administrative center of Apia where positions as public servants, traders, teachers, and medical staff are located. To a considerable and growing extent they are now being replaced by Samoans and part-Samoans. This change is in accord with the trusteeship policy of educating the Samoan towards self-government.

The demographic history of the native population following the impact of western civilization is a broad repetition of that in most Pacific Islands. Exotic diseases, landgrabbing, intertribal conflict, blackbirding, and wholesale exploitation are here repeated. These

vicious activities of the initial European onslaught are evidenced in the early and rapid decline in the native population. Between 1839 and 1881 the reduction in numbers was at least one third. The lowest statistical estimate, in 1919, records a population of only 31,500. In the previous year an influenza epidemic had brought death to 7000 Samoans and halted the rising trend of population. The hiatus was, however, only temporary in the general trend that was evident since 1900 (Fig. 9). In the quarter of century between 1925 and 1950 the native peoples have doubled their number. The phenomenal rate of increase represents a growth of 2774 or 3.68 per cent during 1949–1950. Moreover, the progressive trend has yet to show any sign of abatement. Between the censuses of 1921 and 1945 the average rate of increase was 2.5 per cent per annum which is one of the highest rates of population growth recorded in any part of the world during the last three decades. Although the statistical information is, of necessity, not meticulously accurate, there is little doubt that the population is likely to double itself again within the next 25 years. This would involve an increase in the native population from 72,000 in 1950 to over 140,000 by 1975.[8]

The present density of population in Western Samoa is 70 persons to every square mile of land. The figure conceals the significant contrasts that exist between the two main islands; for Upolu the figure is 105 and for Savai'i only 28 to the square mile. Slightly over one-half of the land area is estimated to be unsuitable for cultivation, but, of the remaining 50 per cent, considerable areas are, at present, unused or only utilized under a migratory form of short-term cultivation. In Upolu the density of population per square mile of cultivated land probably reaches well over 500.

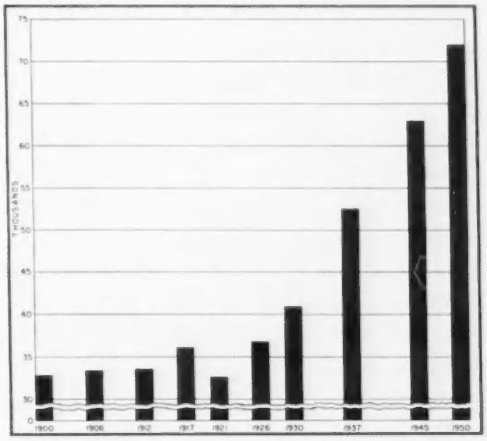

FIG. 9. Changes in the native population of Western Samoa. (Sources: Annual Reports of the Territory of Western Samoa; F. M. Keesing's "Modern Samoa"; and New Zealand Censuses.)

The distribution of the population is markedly uneven and essentially peripheral, features which are evident in the pattern of settlement. Fundamentally, the Samoan is still a village dweller within the traditional communal system. Dispersed native settlement is non-existent in Western Samoa. In contrast, nucleated centers of population are sited on the coast. The form of the village is simple: in almost all settlements there is a general ribbon development along the main coast road although in exceptional cases they have spread inland where the physical restrictions of site and the demands of increasing numbers operate to effect a change in pattern (Fig. 4). The outstanding area of concentration is in Apia and its environs where commercial opportunities and closer association with new and external contacts have occasioned a remarkable expansion of native settlements with severe unavailability

[8] Such a position is predicted in a normally conservative official report. See "Western Samoa (Annual Report) 1949," *Appendices Journ. House of Representatives* (A–4), Wellington, 1949, pp. 42–43.

of agricultural land, building sites, houses, and public utilities.

The town of Apia with a population of 10,000 people is the point of external ocean contacts. It is inadequately served, however, with a semi-sheltered roadstead for ocean-going vessels. A regular fortnightly air service, operated by the National Airways Corporation of New Zealand, utilizes an air strip constructed during the latter years of the 1941–1945 war in the Pacific.[9] It is situated, on the coast, twenty-three miles west of Apia.

The site of the town is on the shore of a wide sweeping bay of the northern coast and is adjacent to the traditional Samoan capital of Mulinu'u. Significantly, the latter's site is the location of the administrative buildings of the Department of Samoan Affairs. Here, reclamation of new land is in progress to provide a building site for the Legislative Assembly. The commercial nucleus of Apia, in which two-storied ferro-concrete and older wooden structures are characteristic, sprawls along the foreshore of the bay. In association are the spacious storage sheds for exports and imports, and the numerous administrative offices. Modern and old buildings are here juxtaposed. At either end of this functional area are European residential districts, each of which possesses a hotel. Inland of these differentiated areas are the native residential districts where blighted conditions emphasize the problem of "urban" drift.

[9] This regional air service connects the Cook Islands, Western Samoa, Tonga, and Fiji with New Zealand and provides a valuable service for passengers and urgent freight. Although economically possible only with the financial assistance of a large subsidy from the New Zealand Government, the service has proved of extreme value since its inception in 1945. Towards the end of 1951 it was taken over by the Tasman Empire Airways Limited which extended the service to Tahiti in the Society Islands with the use of flying boats instead of the original land planes.

In Apia are concentrated most of the 5700 part-Samoans—persons of mixed blood particularly of European and Samoan—in addition to numerous full Samoans and the majority of the 320 Europeans in the islands. The part-Samoans have, characteristically, entered the trades and skilled crafts. They occupy a dominant position in commerce and form the greatest number of skilled workers and artisans. Moreover, many of this group have small holdings or plantations but they are at a disadvantage with the Samoans as they do not have access to native land except through a native wife or relative of Samoan status. Although they enjoy many of the privileges appertaining to Samoan status, for instance in voting and freedom from certain communal regulations, the tenure restriction has confined their economic expansion to activities, other than agricultural. Most of this section of the population prefer to accept the concepts of European modes of life. This is an important reason, *inter alia*, for their concentration in Apia where the modern amenities of western civilization are more readily available. They cluster around commercial and administrative Apia to seek employment as clerks, traders, shop assistants, and laborers. Their status in the community depends, primarily, upon their education and occupation. The unskilled laborer is the least fortunate in Western Samoa where almost everyone has land rights and, thus, is able to achieve self-sufficiency if the living standards of Europeans do not form the welfare aim. The part-Samoans are increasing in number but, of greatest significance, is the economic strength which they may, in the future, seek to wield in political affairs.

The impress of Apia upon the surrounding country is clearly evident in the commercial aspect of agricultural

production, in the increasing population, and in the numerous and populous native villages which not only supply labor for the town's industries but also furnish food for the landless town dwellers. In turn, the parasitic nature of native life in these villages and especially in Apia itself further attracts greater numbers of migrants from the more isolated areas of Upolu and Savai'i. In particular, the proximity to the town market and exporting center, the relatively good network of road communications, and the favorable physical conditions have, in combination, given to agriculture in the area a strong, commercial incentive. The growing population, the enlarged demand for food, and the extension of export crops in and around Apia and its neighborhood are producing a critical disparity between the number of people and the available land.

A LOOMING PROBLEM

Despite the rapid increase in numbers there is, as yet, no general problem of overpopulation. Land still remains to be opened for permanent, conservative agriculture and, with the improvement of road construction, this is occurring. However the expansion is primarily for commercial crops. The dependence on imported foodstuffs and materials is marked in the main centers but this feature is infiltrating into even the more remote villages through the activities of native-managed trading stores which are owned either by Europeans or part-Samoans. Today, the trading store is an almost universal feature of the native villages. In association with these trends is the frequent neglect of subsistence food production; and in the field of animal husbandry, in which the natives have never shown initiative, there is little incentive to improve the poor methods. Animals such as poultry, pigs, and a few cows are an accessory and not an integrated part of the communal system.

The fullest impact of these varied factors is expressed in three main forms: first, in the extension of shifting agriculture into inland regions of dense forest and virgin soils, high precipitation and steep slopes, and long distances from the coastal villages; second, in the increased rate of land rotation within the shifting methods of agriculture; and third, in the fixation of shifting agriculture by the planting of long-term commercial tree crops. At the same time the incidence of accelerated soil erosion is increasing and it has scarred many of the new clearings.[10]

With the increased medicinal and educational services the present population is expected to maintain, at least, the contemporary rate of growth. Moreover, the buoyant export prices are hastening the removal of forest and increasing the planting of food and cash crops. This expansion is economically justified only if the land is not misused. The deforested and sheet-washed slopes inland of Apia bear vigorous witness to the dangers of reckless agriculture. The illogical removal of the forest cover on the steep slopes is at variance with the principles of conservative tropical land use. Moreover, the forest furnishes fuel, building materials, and numerous common resources. Above all else its role in the control of accelerated soil erosion and the conservation of an already problematic water supply is vital.

"SAMOA MO SAMOA"

The *Mau* slogan "Samoa for the Samoans" is rapidly approaching political execution. The next two or three

[10] See T. S. Thompson and C. Marshall: *Report on Forestry in Western Samoa—A Summary*, Apia, 1950 (Cyclostyled).

years will, without doubt, witness further progress in the political development of Western Samoa. The responsibilities of self-government are not, however, solely of a political nature. The fundamental basis of the welfare of the native people is still the products of the soil. Economic prosperity and political advancement cannot be divorced in reality. Secure progress in political affairs is impossible without careful consideration of the future policies in relation to land and people.

The island groups of the Pacific are intimately interested in the political progress of Western Samoa. Here the native people constitute more than 90 per cent of the total population. The trials and tribulations of the people in their movement towards self-government are indicative of those yet to be faced in other similar island groups. The lead and experience of Western Samoa is being keenly followed by the Solomon, Gilbert, Ellice, New Guinea, and Cook Islands and by those of French Oceania and Micronesia where the populous native peoples are becoming increasingly conscious of the new movements. The present powers which administer these various dependent territories are vitally concerned with the problems of Western Samoa, as they indirectly impinge on their own Pacific spheres of influence. Today, more than ever before, political independence and economic insecurity are incompatible as world powers embroil themselves in external conflict.

RESOURCES INVENTORY—A BASIC STEP IN ECONOMIC DEVELOPMENT

Frank Leuer Keller

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THERE has evolved during postwar years a belated though fortunately growing awareness that acute economic instability and the consequent spread of civil strife in the world's underdeveloped areas are direct manifestations of submarginal living standards. In Latin America, governments brought to power by popular revolution on promises of more equitable distribution of wealth cannot long escape the bitter fact that they do not command sufficient capital and technical ability to marshal the nation's resources in favor of its underprivileged masses. In a continuing cycle of disappointment and upheaval these governments collapse before opposition groups offering similar unfulfillable promises of economic and social benefit.

Realization that governmental instability is the natural outgrowth of such economic entrapment has given birth to economic and technical assistance programs designed for various parts of the underdeveloped world. In Asia, and to a lesser extent in Africa, where population density is high in relation to food resources, steps are being initiated simply to alleviate existing production problems which have arisen through centuries of economic maladjustment. In promising areas of lowland Latin America the carrying capacity of the land is being expanded to support a greater population or to satisfy food demands in neighboring geographical regions. The Santa Cruz lowland, a semi-tropical strip lying adjacent to the eastern foothills of the Bolivian Andes, is currently undergoing concentrated economic development. This relatively small region of low population density and abundant undeveloped agricultural resources may soon produce foodstuffs now imported by Bolivia to sustain the densely populated but mineral-rich highlands. Today, in every underdeveloped region of the free world some type of technical assistance program is in progress under the auspices of the Technical Cooperation Administration, the MSA Technical Assistance Fund, the Technical Assistance Division of the United Nations, or the Colombo Plan for Cooperative Economic Development in South and South-East Asia.

Having decided that a rising level of economic life will ameliorate the cultural chaos created by submarginal living standards, and having decided also that accelerated economic activity is an important adjunct to an effective foreign

policy, just what should be the procedure in implementing the development of an underdeveloped land? Coordinated economic endeavor of this type is in the preliminary stage and planners are still in disagreement as to procedure, but previous experience with foreign aid programs has demonstrated a tendency to consider medical attention, such as the establishment of hospitals and public health and sanitation projects, as the first requirement, with education as the second, and public works in the sense of coordinated economic development as the last.

Even prior to the formulation of the Point Four idea, the United States entered into agreements with various Latin American governments for the establishment of public health and education programs. According to the general terms of these contracts, the United States would contribute proportionately less to the program until a termination date beyond which its obligation ceased, while the host government agreed to augment its contribution on a graduated scale until full financial responsibility for an expanded program had been assumed. But what happened? At the conclusion of the stipulated term the host government invariably found public aid too heavy a financial burden; economic activity had remained static while financial obligations had increased. In short, better health and education were not contributing to the nation's economy in proportion to their cost. By not first building a solid economic base, on which to rest a tax system capable of supporting greater social benefits, many governments were forced to curtail these necessary programs.

A Resources Inventory

An alternative and more logical approach to the broader problems confronting these lands might have been to consider first the creation of a permanent employment potential by developing a region's natural resources according to a logical plan, so that health and education programs would have been the self-perpetuating results of higher living standards and an increasing sense of public responsibility. Since employment potential is dependent on manufacturing and agricultural industries stemming from a region's resources—soils, water, minerals, forests, and people—an inventory which determines the location, quality, and quantity of a region's natural endowment, and compiles detailed information on climate, communications, transportation, and population distribution should constitute the first logical step. From this inventory compilation natural resources offering the best possibilities for immediate exploitation, or those which may be utilized to satisfy pressing needs of dependent areas, can be selected for intensive development. Moreover, problems concerning colonization, the location of industry, and construction of transportation and communication facilities are made less difficult. An intelligent developmental plan, therefore, can be formulated only after a resources inventory has been taken. A resources inventory guides economic development just as a blueprint determines the shape of a house.

Although many planners now agree that a resources inventory should receive first priority in implementing economic development, application of this principle has been limited by the belief that inventory compilation is an extremely costly, complex, and lengthy process. In the past, when necessary mapping and interpretation were accomplished by ground survey only, this belief might have had some justification. Today, however, with the free world fighting against time to set its economic

house in order, the aerial camera, the magnetometer, and modern photogrammetric instruments have become the most efficient tools in undertaking a resources inventory. Some detailed mapping and interpretation are still the result of time-consuming field work, of course, but air survey techniques have increased accuracy and speed in detailed mapping and have aided in reducing the time required to complete the compilation and analytical phases of the resources inventory. So if time is an important factor in implementing the economic development of a region, stereoscopic interpretation of aerial photography may be employed over extensive areas. It has been estimated that it would require four field teams of three men each, working through the dry season as well as the rainy season when roads are impassable, two years to complete the land use mapping of a 7500 square mile area surrounding Santa Cruz. Aided by aerial photography and modern photogrammetry these same field teams could duplicate this work during one five months' dry season, thus lowering costs considerably.[1]

But what is the overall cost of a resources inventory? Obviously no cost estimate per unit of area can be made without considering the scope of the contemplated survey, accessibility of terrain, and contribution, in money or facilities, of the host government. In the Santa Cruz region aerial photography was accomplished by the Bolivian Air Force, which contributed a completely reconditioned two-engined airplane adapted for aerial photo work, an aerial camera, a crew of four including the pilot, photogrammetrist, camera technician, and mechanic, and the laboratory facilities and personnel involved in developing and printing the photography. The Point Four contribution included only the services of a technician and the film, paper, and developing chemicals. Thus the Bolivian contribution to this particular phase of the program was approximately twenty times that of Point Four.

Another factor to be considered in determining the ultimate cost of a resources inventory is the availability of accurate inventory data and sound recommendations which removes a great deal of the speculative element from the investment of capital, and results in important economies through direction of capital to areas and industries in which it is most likely to profit. *La Belgica* and *La Esperanza* are Santa Cruz's finest sugar refineries, the postwar construction of which consumed large sums obtained from private and public sources. The refinery sites were selected without benefit of a resources inventory to determine the location and state of transportation routes feeding the area, and without first determining the amount of better quality soils available for high yield cane growth. Already it is becoming evident that finer quality soils are not sufficiently abundant in the vicinity of these refineries, necessitating the purchase of cane farther afield. This cane is subject to high transportation charges and the loss of sucrose content while being ox-carted over poor roads—a considerable financial handicap in a highly competitive industry. In many instances an adequate resources inventory not only pays for itself, but may prevent false starts and eventual failure in regions capable of considerable development. Using cost estimates from the Santa Cruz region as a guide, it

[1] Clarence F. Jones, Frank Leuer Keller, and John F. Lounsbury: "Plan for An Area Analysis of the Santa Cruz–Cochabamba Region of Bolivia," 39 pps., mimeographed, Northwestern University, October, 1951.

can be stated that the investment in a resources inventory should not exceed 3 per cent of the cost of subsequent construction and development work based on the survey.

OBJECTIVE AND PROCEDURE

A resources inventory measures the resource potential of a region under consideration for development, that is, the quality and quantity of available resources are determined, their location pinpointed, and an estimate is made of the extent to which they can be utilized in accomplishing the developmental objective. In estimating the developmental potential of any particular region the availability of six classes of resources is determined:

1. Agricultural—soils, crop, pasture, and undeveloped land
2. Forest—economic species (height, density, site)
3. Mineral—varieties of high economic return
4. Water—power sites, irrigation, general use
5. Climatic—rainfall distribution, temperature extremes, climatic accidents
6. Human—population distribution, stage of development (i.e., labor force, health, transportation, capital).

Associated cultural factors, such as legislation, tax structure, land tenure systems, and political and emotional stability on a national and international scale, may have an important bearing on the degree to which a resource or a region can be developed, and each must be given proper consideration in assessing developmental potential.

The essential phases of a resources inventory—compilation, analytical and developmental—and the procedural steps in each phase may be outlined first to simplify presentation:

A. Compilation
   1. collection and indexing of existing data
   2. aerial photography
   3. photogrammetry

B. Analytical
   1. field mapping and interpretation
   2. special studies

C. Developmental—planning and effectuation

During the compilation phase pertinent data on the region subjected to investigation are accumulated and catalogued. Aerial photography on a suitable scale is obtained, and an accurate base map is constructed with the slotted template or by photogrammetric means. Thus the compilation phase may be compared to library research associated with the doctoral dissertation. The analytical phase, comprising field mapping on aerial photographs, stereo-interpretation, and the special studies, is time-consuming and exacting on the technicians attached to the resources inventory team. Detailed study required for this type of analysis would be analogous to field research preceding the dissertation. Carrying this analogy somewhat further, the resources inventory includes a developmental phase which may be related to the conclusions reached in the dissertation; information obtained during the preceding two phases is now utilized to plan and implement the orderly economic development of a region.

A. The Compilation Phase

1. *Collection.*—Pertinent data concerning the area are collected and coordinated under specific categories, for example, agriculture, forests, minerals, water, climate, mapping, and

legislation. Ample ground control is required to construct accurate maps from aerial photographs, so engineering plans for highways and railways are exceedingly useful. Geodetic information containing exact measurements between objects easily identifiable on aerial photographs should be obtained. In jungle areas where available landmarks are apt to be confused, or in areas where existing maps are inaccurate, additional low order triangulation may be advisable. Thus all data from which ground control information may be obtained are collected for later use.

A questionnaire is also compiled for use during the analytical phase of the resources inventory. This questionnaire, phrased to obtain specific data on types of crops, yields, and other information useful to those engaged in field mapping and the interpretation of aerial photographs, is completed in the field by a member of the mapping team. Copies of legislative and other regulatory measures which might conceivably have an effect on economic development are set aside for future reference.

Availability of accurate statistical material generally depends on the cultural development of the region. Possible exceptions may exist in Latin America where, in compiling the 1950 Census of the Americas, questions were phrased so that data would have international significance. Statistical information obtained in one country was made comparable, insofar as possible, to that obtained in another, and the various censuses were planned to contain types of information most useful for developmental purposes. In Latin America, therefore, collection of information is a somewhat easier task than in most other underdeveloped areas where census data are exceedingly inaccurate or non-existent.

2. *Aerial Photography.*—Expensive equipment and highly specialized personnel are required to insure success of this portion of the resources inventory. Minimum equipment needed is an airplane adapted for aerial photography capable of flying at sufficiently high altitudes to obtain the small scale photography with which the larger areas are first surveyed, and an aerial camera with a lens of 6″ focal length. A Beechcraft C-45 twin-engined plane and a Fairchild K-17 aerial camera were employed by the Bolivian Air Force to obtain photography of the Santa Cruz region. In areas where detailed information on subsurface geology is desired, a plane carrying a magnetometer measuring differences in rock densities is used—a highly specialized operation which must be coordinated with accurate field work for satisfactory results. Unless the aerial photography conforms to rather exacting specifications, the value of the critical area analysis and the special studies will be impaired. The aerial photography may be accomplished under government auspices if the proper equipment and trained personnel are available, or a private company specializing in this type of inventory work may be contracted.[2] Developing, printing, and indexing the film and charting the magnetometer readings conclude the photographic step.

3. *Photogrammetry.*—Existing maps of underdeveloped areas generally are based on reconnaissance information, and therefore are too inaccurate for resources inventory purposes. An accurate base map on which to plot data interpreted from aerial photographs and field research is absolutely necessary. Construction of this base map

[2] See "Standard Specifications for Aerial Photography for Stereoplotting Instruments" (revised), U. S. Geological Survey, November 30, 1951.

early in the developmental stage anticipates many future needs of a region. As land becomes more valuable accurate maps guarantee the security of titles and facilitate the transfer of property. Since accurate maps will be required sooner or later, the resources inventory provides for them during an early phase in the region's development.

B. The Analytical Phase

1. *Field Mapping and Interpretation.*—Maximum effort is made to insure that field mapping and stereo-interpretative work is both accurate and significant. For mapping and interpretative purposes a field team composed of persons able to work cooperatively is desirable. The minimum personnel comprising a field team are: 1. mapper, 2. assistant mapper, and 3. interviewer. The mapper and assistant mapper are trained technicians familiar with the technique of mapping on aerial photographs by the representative fraction method.[3] The interviewer is a native of the area under study who is familiar with the language, people, and terrain. A rather detailed knowledge of local crops and yields is beneficial. He should be sufficiently discreet to act as a liaison between the field team and the inhabitants and local authorities. While not otherwise occupied, the interviewer obtains information required by the questionnaire prepared during the compilation phase. Mobility for the field team is provided by the ubiquitous jeep, but travel by foot or horseback may be necessary to reach the less accessible portions of underdeveloped areas, especially during a rainy season. At any rate, sufficient ground must be covered by the field teams to insure accurate stereoscopic interpretation of the unvisited portions of the area.

Types of cultural and physical features which may be mapped by the representative fraction method are outlined for illustrative purposes:[4]

A. Cultural Landscape
   1. cropped land—type of crop
   2. quality of yield—good, average, poor
   3. pasture land—nature and carrying capacity
   4. forest—species, height, density, site
   5. non-productive land—capability
   6. towns—areas outlined, population estimated
   7. roads—classification based on local needs and realities
   8. other cultural landscape features by symbol

B. Physical Characteristics of the Land
   1. soils—classified as to capability
   2. slope—effect on irrigation and mechanized equipment
   3. erosion—type and degree
   4. drainage—degree of run-off.

Important decisions concerning the resource potential and developmental procedure in underdeveloped areas are based on conclusions drawn from the analysis of land use and land capability maps. It might be emphasized at this point that these maps comprise a permanent record of incalculable value which may bridge the gap caused by lack of continuity in the assignment of technical personnel to underdeveloped areas. The entire concept of economic and technical assistance to underdeveloped areas may one day be challenged if program continuity cannot be estab-

[3] "Land Classification," National Resources Planning Board, U. S. Government Printing Office, 1936.

[4] Jones, Keller and Lounsbury, *op. cit.*

lished by some means. Present tours of duty are altogether too brief, tending to coincide with those of foreign service officers attached to the local embassy rather than being keyed realistically to the nature of the assignment. Before positive results are realized the technician is replaced by another who spends many months familiarizing himself and his family with strange new surroundings and a foreign idiom. Only at the termination of this period of readjustment can the fresh technician undertake the unfinished work of his predecessor. Lacking a firm understanding of past accomplishments and a general comprehension of developmental aims, it is most difficult for him to continue the pattern of investigation already established. If modern man is incapable of capturing the colonizing zeal of the early Jesuits or the pioneering spirit of his more recent progenitors, the resources inventory, based on the permanent record contained on photographs and maps, may serve as an indispensable master plan providing continuity for the disjointed succession of technicians and planners who, over a protracted period, will be responsible for implementing the economic development of a region.

2. *Special Studies.*—Although most problems requiring intensive investigation cannot be concluded until aerial photography or land use maps are available, preparatory study of the basic aspects of any problem may begin immediately. Technicians assigned to the special studies need considerable practical and theoretical experience in dealing with the particular problems they are to investigate. Therefore, government technicians stationed in foreign areas may be temporarily reassigned to the resources inventory team for the duration of the project. Herein lies an opportunity for the director of an economic development program to eliminate, insofar as possible, the conflicting responsibilities and separatism characteristic of the several government agencies to which the technicians are permanently attached. In becoming part of a team responsible to a coordinator, their contribution can be molded to represent the broader interests of the developmental program. And fewer foreign technical experts will be required to study overlapping problems and direct the developmental effort.

Space does not permit an exhaustive treatment of the nature of special studies, but a few examples may be presented to illustrate their restricted scope when compared with the more general picture obtained from the field mapping and interpretation. A special study might be created to determine hydroelectric and irrigation possibilities at specific sites of immediate interest, plan a more efficient transportation network, investigate sites for the location of industry, or estimate the value of forest species of high economic return. For most studies of this nature, even if they are not a part of the complete resources inventory, aerial photography is desirable. Under existing hit-or-miss developmental methods, the cost of spot photography is prohibitive, whereas obtaining high-level photography of the entire region under development is a preliminary step in the resources inventory.

For example, hydroelectric and irrigation possibilities are determined by correlating the interpretation of aerial photography with precipitation records obtained during the compilation phase. Streams are classified into two general categories: (1) a potential source of power or irrigation and (2) negligible power or irrigation potential. Flow meter records are then made on Category

1 streams and, in order to locate potential storage basins, stream profiles are determined from stereoscopic interpretation of the aerial photography. The total value of any forest type or crop may be estimated by using aerial photography to determine volume per acre and the total number of acres, and multiplying the product by the unit value. Regional structure, outcrop areas, and, in some instances, actual rock formations may be identified or interpreted from aerial photography. Magnetometer readings, known geology, laboratory examination of field specimens, and reconnaissance work aid in these identifications.

C. The Developmental Phase

Unless the responsible citizenry is favorably disposed toward the employment of a region's economic potentialities to promote the general welfare, technical studies resulting from the compilation and analytical phases of the resources inventory would become sterile, isolated, and useless accumulations of information. To insure that creation of a broader economic base, and the greater human dignity which this implies, shall not be choked off at the point of implementation by lack of adequate guidance, the planning and effectuation of progressive economic expansion constitutes a logical and necessary final phase of the resources inventory.

Tremendous responsibility rests on those individuals empowered to make policy decisions initiating the economic evolution of a region. The successful planner possesses a broad educational background and experience far removed in depth and scope from that of the technician on which the preliminary phases have been so dependent. He must demonstrate an ability to grasp cultural and physical interrelationships within the area and give them international perspective. In dealing with officials of the host government, discretion and diplomacy are essential, yet the coordinator must generate sufficient personal force to exert a favorable influence on legislative and agrarian policy. He must intelligently reweave the warp and woof of a region's cultural fabric if a balanced economy is eventually to evolve which, once put into motion, will continue to move forward with little further assistance.

The attitude of law-makers has an important influence on the extent to which development can take place. Existing legislation should be revised to favor local production or at least should have no deleterious effect on it. Expert technical advice and generous economic assistance are not only wasted but are harmful to the world prestige of the donor government if the group in immediate control of a region fears the political and social consequences of greater productivity. In some areas, legislation may be designed to favor the importer of foodstuffs living in a large commercial center over the local producer who cultivates the land. Often this is accomplished by means of a multiple exchange system which permits businessmen to import agricultural products at a greatly reduced rate of exchange, while all others must use a fixed higher rate or the inflationary free rate. In this manner the national producer is undersold in his own trade area despite such normally beneficial factors as proximity to market, cheap labor, and, in some instances, low transportation rates which would logically be expected to tip the scale in his favor. As a result, agricultural production declines while more food is imported to meet the increasing demand.

Intelligent planning and effectuation is the result of a unitary way of thinking. Immediate action is taken to foster settlement and increase production in areas where land capability exceeds land use. If necessary, colonists are attracted by offers of free land similar to those which promoted development of the American West and by long term loans, guaranteed markets, agricultural extension services, and other inducements. Or conservation practices are recommended for immediate implementation on land where capability is strained or exceeded by actual usage. The introduction of health facilities, the spread of public education, and the gradual absorption of colonists must be regulated to the economic growth of a region. The deleterious effect of permitting these services to outrun a nation's economy has already been shown. And without an adequate transportation system over which to carry the increased production of an emerging area, the extent of economic development is definitely limited. Due to isolation in the past, the abundant natural resources of Bolivia's Santa Cruz region have remained largely untouched. If it were not for the all-weather highway soon to link Santa Cruz's high agricultural potential with the highland's dense population, attempts to develop this region beyond self-sufficiency would be predestined to fail.

IN CONCLUSION

A recurring theme in this discussion has been the urgent need for devising a rapid and efficient procedure for raising the level of economic life throughout the underdeveloped world. The author's personal experiences with poor people in rich lands indicates that they are no longer disposed to await the normal course of events for deliverance from their misery and poverty. These unfortunates will pledge allegiance to that cause promising immediate hope in the form of better food and shelter, health and education. The aspirations of millions of these underprivileged people may be realized as a greater share of the resource potential of underdeveloped areas becomes available to them. Methods must be devised to hasten the orderly management of this resource potential while not overtaxing the abilities of governments and agencies pledged to support this most humanitarian cause. But to plunge hastily into a developmental program without first making an adequate assessment of a region's natural endowment would appear to be placing the cart before the horse. The resources inventory, therefore, is proposed as an indispensable tool for those architects of economic and technical assistance who, presently under great administrative stress, are striving to create favorable conditions for the rapid and efficient utilization of a region's resources.

THE GREAT LAKES COAL TRADE: PRESENT AND FUTURE

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THE coal trade on the Great Lakes has shown a vast expansion during the first half of the present century and today it stands as the most dynamic traffic on our "Inland Seas." True, the yearly tonnage of iron ore is greater and the rise in volume of limestone shipments has been more marked percentagewise (the tonnage is less than half that of coal), but both have a far less complex series of factors coming into play in their development. This, of course, arises from the more varied market for coal.

In 1950 more than 57.6 million net tons of coal—principally bituminous—were shipped from 14 American Great Lakes ports (Table I and Fig. 1). Over 16.3 million tons or 28 per cent of the total moved to Canadian ports.

Before going further, let us see the position of the Lakes coal traffic in the national scene. Eleven per cent of the country's 1950 production of bituminous coal (512.9 million tons)[1] was transshipped through Great Lakes ports. The proportion of our export coal passing through these ports is even more impressive. In 1950 foreign shipments of bituminous coal amounted to slightly less than 25.5 million net tons.[2] Thus, about two-thirds (64 per cent) of this export fuel moved over the Great Lakes.[3] Our northern neighbor took 23 million tons of the total exported; hence 71 per cent of this—the world's greatest single-commodity trade between two countries—was handled by lake vessels. Basic reasons for the large international traffic on the Great Lakes are the concentration of much of Canada's economic life on or near its shores and the absence of coal in the provinces of Quebec, Ontario, and Manitoba. While Canada received about 3.8 million tons of anthracite from the United States in 1950 (nearly all of our exports), only a small percentage appeared in the Great Lakes trade.

Both the volume of coal shipments and the relative importance of the ports handling this traffic have shown a great change during the past half century. As shown in Figure 2, shipments from the ten Lake Erie ports have increased about

[1] U. S. Bureau of Mines, *Bituminous Coal and Lignite in 1950*, Mineral Market Report No. 2032.

[2] U. S. Bureau of Mines, *International Coal Trade*, Vol. 20, No. 1, Jan. 1951, p. 38.

[3] Seaboard exports of bituminous coal were low in 1950 compared with other postwar years. For example, the shipments to Europe totaled 0.8 million tons, while in 1949 they were 8.7 million tons. An all-time high in soft coal exports was set in 1951 when the total reached 56.7 million tons, with the volume to Europe amounting to 27.9 million tons (U. S. Bureau of Mines, *International Coal Trade*, Vol. 21, No. 1, Jan. 1952, p. 54). The recent large shipments, particularly from Hampton Roads, have resulted, however, only because of western Europe's abnormal situation.

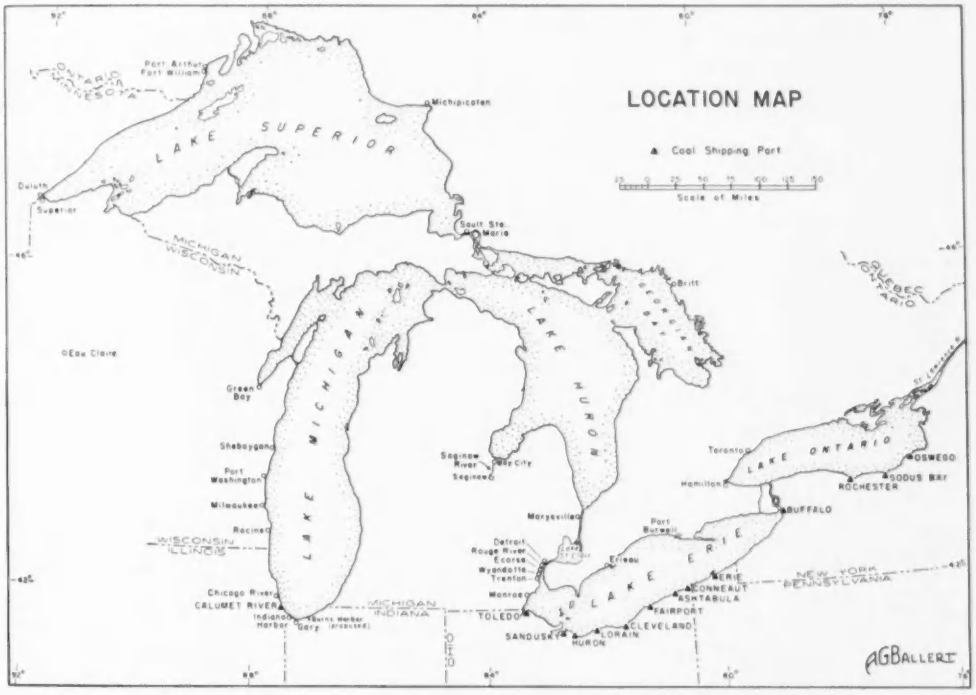

FIG. 1. Fourteen American Great Lakes ports shipped coal in 1950.

fivefold during the period, accompanied by a change in the principal transshipping ports.

Basic to the total tonnage increase has been the expanding economy of the Great Lakes region. The steady growths of industry and of population in the southern portion of the region are key features and they, in turn, have added further to the growing demand for electricity. Power in the Lakes region, an area of relatively low topographic relief, is largely produced by steam plants which are, in increasing numbers, being fueled with lake coal.

The migration westward of the leading rail to water coal transfer points is primarily due to another shift—that of the center of bituminous coal production. Whereas, the southern West Virginia and eastern Kentucky-Tennessee district was the source for 37 per cent of the fuel shipped on the Lakes in 1917, the percentage had risen to 65 by 1945.[4] The change was not entirely a tranquil one, however, for the early years were marked by turbulent rate controversies between the Pennsylvania-Ohio and the southern mine operators.

LAKE ERIE COAL PORTS

While the ports of eastern Lake Erie have fallen in their relative importance in the lake coal trade, not all have declined in tonnage. In the last two decades, however, those lying east of Cleveland have shown no significant gains. It should be noted that Buffalo's prominent position in the early part of the century was due almost entirely to anthracite, and the lake traffic in this commodity has decreased sharply since

[4] Albert G. Ballert: "The Coal Trade of the Great Lakes and the Port of Toledo," *Geogr. Rev.*, Vol. 38, 1948, p. 198. Statistics showing the origin of the bituminous coal shipped over the Great Lakes are no longer published by the U. S. Bureau of Mines. For an analysis of the dynamics of this subject see Raymond E. Murphy and Hugh E. Spittal: "Movements of the Center of Coal Mining in the Appalachian Plateaus," *Geogr. Rev.*, Vol. 35, 1945, pp. 624–633.

TABLE I

BITUMINOUS AND ANTHRACITE COAL SHIPPED FROM GREAT LAKES PORTS, 1950[a]

(Net tons)

Shipping Port	Bituminous			Anthracite[b]
	Total	To U. S. Ports	To Canadian Ports	Total
LAKE ERIE	50,364,578	37,611,061	12,753,517	601,503
Toledo	26,059,549	20,833,297	5,226,252	.....
Sandusky	9,819,190	8,285,190	1,534,000	328
Lorain	3,236,705	1,726,789	1,509,916	.....
Ashtabula[c]	3,077,918	882,788	2,195,130	121,779
Conneaut	2,520,266	2,186,898	333,368	.....
Erie	2,049,682	1,413,299	636,383	174,090
Huron	1,809,856	1,602,074	207,782	.....
Fairport	1,297,186	509,104	788,082	.....
Buffalo	281,546	[d]	281,546	305,306
Cleveland	212,680	171,622	41,058	.....
LAKE ONTARIO	3,993,459	1,020,989	2,972,470	140,239
Sodus Bay	2,138,534	958,729	1,179,805	12,636
Rochester[c]	1,213,247	.....	1,213,247	2,655
Oswego	641,678	62,260	579,418	124,948
LAKE MICHIGAN	2,486,107	2,043,583	442,524	.....
Calumet R.	2,486,107	2,043,583	442,524	.....
Total	56,844,144	40,675,633	16,168,511	741,742

[a] Statistics were provided by the Great Lakes Regional Statistical Office, U. S. Corps of Engineers, Detroit, and are preliminary and subject to revision until published in the *Annual Report of the Chief of Engineers, U. S. Army.*

Bunker coal is not included. According to data provided by the Ore & Coal Exchange, Cleveland, in 1950 the total vessel fuel loaded at the ten Lake Erie ports was 1,325,095 net tons.

[b] To American ports, 628,815 tons; to Canadian ports, 112,927 tons.

[c] Includes car-ferry shipments: Ashtabula, 289,605 tons and Rochester, 53,365 tons.

[d] Intraport shipments of 197,939 tons are not included. Although the movement is only about seven miles to Tonawanda, regular bulk-type freighters are normally used in this traffic.

the early 20's.[5] The port handled about 40 per cent of the anthracite lake shipments in 1950, and its proportion of the total will undoubtedly remain high as a result of proximity to the northeastern Pennsylvania mines. The bituminous coal shipments to points beyond the port were, however, smaller in 1950 (Table I) than the lake receipts of this commodity—330,361 tons. Today, Buffalo's principal lake traffic is grain and, in this commodity, it leads as a receiver.

Cleveland, midway along Erie's southern shore, has fallen from first place among the coal shipping ports at the start of the century to last place in 1950. It is improbable that this port will rise much in this traffic in the future, although it leads all lake ports in the receipts of iron ore (over 11 million gross tons in 1950). Two railroads have discontinued their coal dock operations (the B & O in 1919 and the Erie in 1946), but the remaining loading dock (Pennsylvania) appears likely to remain. A major factor for its continuance is the afore-mentioned huge receipt of iron ore. The vessels bringing this cargo can be refueled with coal more speedily with the car dumper than by other methods. In 1950, bunker fuel (not included in Table I) loaded at this dock totaled 129,000 tons. Some of the reasons for Cleveland's decline are

[5] Buffalo was the first million-ton port on the Great Lakes, shipping 1,253,940 tons of coal as early as 1883 (*Annual Report of the Chief of Engineers: 1888*, Part 3, p. 2055).

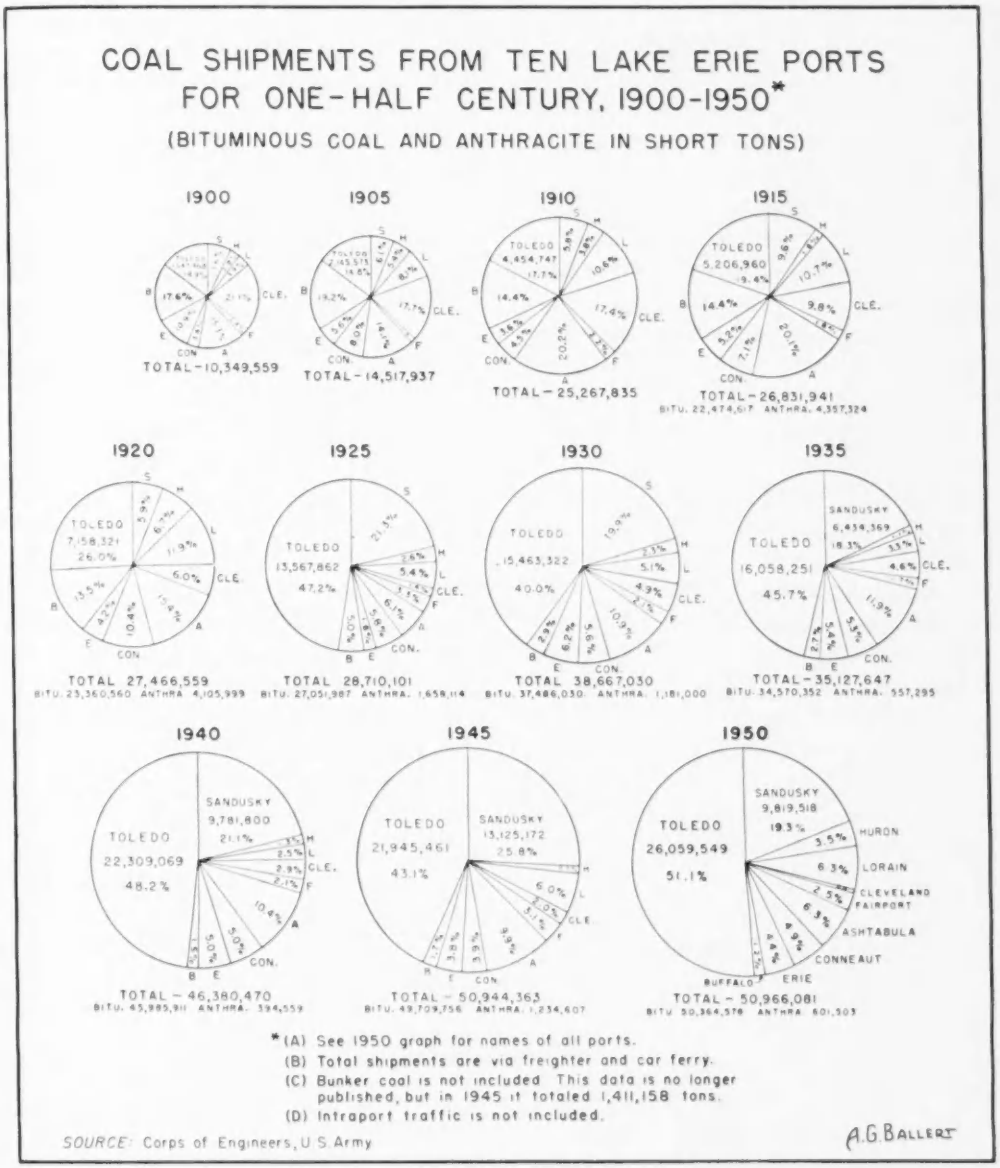

FIG. 2. Chart of growth of coal shipments at 10 Lake Erie ports.

of interest. One was the previously-mentioned shift in major sources of lake coal. While the western Pennsylvania fields were prominent in this trade, the lower rates to Cleveland over Toledo and Sandusky were a significant attracting force. For Ohio coal, however, the rates are competitive, and for the West Virginia–eastern Kentucky fields, Toledo and Sandusky have virtually a monopoly on the coal for lake shipment. The exhaustion of the Canadian Pacific's mines in southeastern Ohio contributed substantially to Cleveland's decline in coal shipments.[6]

At the southwestern corner of Lake

[6] Interview with Mr. W. P. Stuart, General Coal and Ore Agent, Pennsylvania Railroad, Cleveland.

Erie, on Maumee Bay and River, is Toledo, the coal port which ranks first not only in the Great Lakes region, but also holds the world's top position. In 1950, shipments of more than 26 million tons of coal (all bituminous) surpassed the port's former record by about 2.5 million tons. An analysis of statistics for other major coal shipping ports of the world—past and present—brings the writer to conclude that Toledo's 1950 tonnage was the greatest yearly volume of coal ever shipped from a single port. The nearest competition appears to come from Cardiff, Wales, and Newcastle, England, who, at their zeniths in 1913, had coal shipments of about 25 and 22.4 million net tons respectively.[7] While Hampton Roads, Virginia, handled 37.9 million tons (exports 20.7) in 1947 and 31.7 million tons (exports 14.0) in 1948, this grossly abnormal volume was loaded through the two ports of Norfolk and Newport News. In 1950 Hampton Roads' coal shipments totaled 13.5 million tons (exports 2.1), about half the Toledo volume.[8]

By 1920 Toledo had become well established as the leading coal port on the Lakes, and since then it has steadily expanded its tonnage and strengthened its position (Fig. 2). In 1950, 45 per cent of the second-ranking Great Lakes bulk traffic was shipped through the two coal docks which lie adjacent to one another at the head of Maumee Bay just beyond the city limits (Fig. 3). Here the Chesapeake & Ohio Railroad has its only coal loading machines on the Lakes. The New York Central–Baltimore & Ohio jointly-owned facilities were placed in operation in 1948. Earlier, the two companies had separate loading docks upstream about a half dozen bridges and a similar number of miles.

While a number of reasons may be given for Toledo's supremacy as a coal transfer point, they generally have a geographic basis—location with respect to the Middle Appalachian coal fields, focal point of many rail lines, proximity to the Lower Rivers (the Detroit and St. Clair) for quick turnabouts, almost limitless tracts of flat lake plain for the development of huge classification and assembly yards, and one of the longest periods open for navigation of any lake port. Actually the season is year-around since coal moves to the Detroit area (River Rouge) throughout the winter, the only continuously operated freighter route on the Lakes (Indiana Harbor's petroleum and gasoline shipments are only discontinued for about 6 weeks). From January through March, 1950, the coal shipments amounted to 612,160 tons.

The old adage about "coals to Newcastle" can be applied to Toledo for, despite its huge shipments, about 419,000 tons of bituminous coal were received at the port in 1950 for use in the blast furnaces. This peculiar movement of coal from the mines to Sandusky by rail and by lake carrier from this port to Toledo is largely due to the variance between all-rail and rail-water transportation rates.

DESTINATION OF LAKE ERIE SHIPMENTS: 1925 AND 1950

Before considering the coal shipments from lakes Michigan and Ontario, let us note the destination of Lake Erie coal. Table I and Figure 2 show the 1950 shipments from Lake Erie ports to be about 51 million tons. In Table II the destinations of the coal for that year and 25 years earlier are grouped

[7] Ballert, *op. cit.*, p. 203.

[8] The 1951 aggregate shipments of more than 40.7 million tons set a record. Exports accounted for slightly over 29 million tons (U. S. Bureau of Mines, Weekly Coal Report, No. 1794).

TABLE II

COAL SHIPMENTS TO VARIOUS GREAT LAKES DISTRICTS FROM TEN LAKE ERIE PORTS, 1925 AND 1950[a]

(Net tons)

Lake District	*Year*	*Bituminous*			*Anthracite*[b] *Total*
		Total	*American Ports*	*Canadian Ports*	
Lower rivers[c]	1950	11,873,008	10,667,974	1,205,034	9,146
	1925	1,789,358	1,135,954	653,404	.....
Lake Michigan	1950	11,389,806	11,389,806	.....	267,945
	1925	8,203,007	8,203,007	.....	.....
Lake Superior	1950	10,723,924	9,289,410	1,434,514	329,049
	1925	11,648,534	10,841,678	806,856	.....
Welland Canal and L. Ontario	1950	4,848,405	13,042	4,835,363	.....
	1925	936,696	61,976	874,720	.....
Lake Huron and Georgian Bay	1950	4,255,836	2,512,104	1,743,732	.....
	1925	1,024,980	341,829	683,151	.....
Lake Erie	1950	4,159,166	2,952,673[d]	1,206,493[e]	5,271
	1925	1,491,697	922,980	568,717	.....
Sault and river ports	1950	2,872,889	779,636	2,093,253	.....
	1925	1,209,446	618,014	591,432	.....
Total	1950	50,123,034	37,604,645	12,518,389	611,411
	1925	26,303,718	22,125,438	4,178,280	1,717,695

[a] Statistics are from the *Annual Report of the Lake Carriers' Association* for 1925 and 1950, Cleveland. The minor variance of the 1950 totals from those in Table I result from the use of different sources.
[b] Only the total for all districts is available for 1925.
[c] Detroit and St. Clair rivers.
[d] Excludes Buffalo's intraport shipments.
[e] Excludes Ashtabula's car-ferry shipments.

into seven districts.[9] A quarter century ago 84 per cent of the bituminous coal went to American ports, while in 1950 the proportion was 75 per cent.

The most remarkable growth has taken place in the Lower Rivers (Detroit–St. Clair) district. In climbing to first position, the receipts have increased by more than 10 million tons. This reflects the great expansion in industry and power generation facilities here. Over 70 per cent of the lake coal to this district comes at present from the nearest coal port—Toledo. While the water haulage is short, the saving of 30 to 50 cents per ton in transportation charges over the all-rail rate has prompted the growth in use of the lake freighter for the 40–50 mile trip. At ports which are farther from the coal fields than this lake district, the economic advantage of lake transportation becomes more pronounced. The other districts all made substantial gains in coal receipts over the 1925–50 period except for Lake Superior. The Lake Huron–Georgian Bay district reached a new high in 1950. While Lake Michigan receipts are well above the figure of 1925, during World War II they went above 15 million tons. Several features of the Lake Michigan coal trade which are mentioned later in this paper are significant factors affecting the activity there.

[9] The difference in totals for Tables I and II is due to the use of two sources and the inclusion of the car-ferry traffic of Ashtabula in Table I.

COAL PORTS OF LAKES ONTARIO AND MICHIGAN

Along the southeastern shore of Lake Ontario are three ports which shipped

a total of more than 4 million tons of coal in 1950 (Table I). The majority went to Canadian ports, but some moved to American harbors. Similar to the Sandusky to Toledo alongshore traffic is the movement from Sodus Bay to Oswego, 30 miles to the east. Shipments are normally to eastern Lake Ontario and upper St. Lawrence ports. The western end of Ontario (Toronto and Hamilton) and points along the Welland Canal are served from Lake Erie ports. Sodus Bay, also known as Sodus Point, is the leading transshipment center, and the 1950 tonnage set a new high.

The most recent coal shipping point to be developed on the Lakes is located at the southern end of Lake Michigan, on the Calumet River (Chicago), a point which is also one of the major coal receiving ports (Table III). Inaugurated during the war (1942), the tonnage has steadily increased until in 1950 it was nearly 2.5 million tons. Preliminary data for 1951 shows the volume to be nearly 3.8 million tons, a figure which will establish this as the third-ranking coal port on the Lakes. The coal shipped comes from western Kentucky, central and southern Illinois, and Indiana, with over half the volume originating in the first-mentioned location.[10] None of these fields produce coking coals, an explanation for the large lake coal receipts at this iron and coal center. Destinations of the Calumet River coal have had a marked change in the last few years. In 1948, over 1.6 million tons, or 77 per cent of the total shipments, went to Canada, whereas, in 1950 exports were only 18 per cent of the total shipped (Table I). Over 90 per cent of the greatly increased domestic shipments had Lake Michigan ports as destinations. This abrupt shift largely has resulted from the decrease in coal purchases by Canadian railroads and the expanding public utility and industrial market along the shores of Lake Michigan. These changes will be considered at a later point.

[10] Interview with Mr. L. M. Geisall, General Manager, Rail to Water Transfer Corp., Chicago.

TABLE III

MAJOR COAL RECEIVING PORTS ON THE GREAT LAKES, 1950

(Receipts of 1 million net tons or more)

	Bituminous[a]
United States ports	
Port of Detroit[b]	9,487,603
Detroit	*3,791,005*
Rouge River	*3,064,790*
Wyandotte	*1,319,297*
Trenton	*1,076,888*
Duluth-Superior	7,994,319
Milwaukee	3,329,007
Green Bay	2,020,338
Saginaw River	1,878,590
Indiana Harbor	1,712,633
Calumet River	1,397,167
Canadian ports	
Hamilton	2,092,831
Sault Ste Marie	2,057,190
Toronto	1,827,860
Ft. William–Pt. Arthur	1,296,697

Sources: U. S. ports: Great Lakes Regional Statistical Office, U. S. Corps of Engineers, Detroit.

Canadian ports: Dominion Bureau of Statistics, *Shipping Report, 1950*, Ottawa, 1951.

[a] Only Duluth-Superior, Milwaukee, and Toronto are important in the anthracite trade, having receipts of 297,814 net tons, 275,975 tons, and 93,440 tons respectively. The Lake Carriers' Association indicate a 1950 total for Milwaukee of 229,433 tons, but the Wisconsin Coal Bureau figure (276,309 tons) is similar to that of the Corps of Engineers.

[b] Statistics of the port are available for several localities. In addition to the four indicated, Ecorse had coal receipts of 235,623 tons which are included in the port total.

COAL RECEIVING PORTS

In 1950, twelve Great Lakes ports each received over a million tons of coal (Table III). While these major ports are found along the shores of all of the lakes except Erie, they are principally within the zone of the Central Manufacturing Belt of the United States and Canada. Exceptions are Duluth-Superior, Fort William–Port Arthur, and Sault Ste Marie. The two twin ports at the head of Lake Superior forward much of their receipts to interior points (Fig. 4). The Canadian Sault, however, utilizes most of

its receipts locally. Expansion of the Algoma Steel Corporation has been a major factor here. Other iron and steel ports are the Rouge River (Detroit), Indiana Harbor, Calumet River, Hamilton, and Duluth. Steam power plants utilize a large portion of the coal received along the Saginaw River. Two ports—Duluth-Superior and Milwaukee—receive most of the anthracite shipped on the Great Lakes. At some ports coal is the only traffic or nearly so. Examples are Sheboygan, Racine, and Port Washington in Wisconsin, Britt, Ericau, and Port Burwell in Ontario, and Marysville and Monroe in Michigan.

FIG. 3. Air view of Toledo's coal docks on Maumee Bay at the mouth of the Maumee River. In the foreground are the new Baltimore and Ohio–New York Central docks. The Chesapeake and Ohio docks are in the middle distance. Note the great expanse of rail yards. (Courtesy of M. C. Zink, Toledo Photographic Service.)

Having considered the two ends of the Great Lakes coal routes, let us now turn to some of the features which are presently contributing to the dynamics of this trade or may do so before long.

TRENDS IN USE OF LAKE COAL BY RAILROADS AND POWER COMPANIES

Two major consumers of lake coal are currently having opposite effects upon the volume of this commodity traffic. They are the railroads and the power companies. Diesel and oil-fired steam engines have reduced the needs of the former group, while the expansion of steam plant facilities along the shores of the Lakes has increased the requirements of the latter. Change in the national consumption of bituminous coal by railroads (Class I) and electric utility companies from 1940 to 1950 was a 28 per cent decrease by the

former users and an increase of 80 per cent by the latter group.

To exemplify the effect of oil-powered locomotives a comparison may be made of the coal received in 1948 and 1950 at lake docks by the Canadian Pacific Railway for consumption on their lines. In 1948 the total was 1,828,378 tons, and, two years later, it was only 388,383 tons. This decrease of 79 per cent was due in large part to the conversion to oil-burning engines, but another factor is the greater use of western Canadian coal.[11] Another, but smaller Dominion railroad—the Algoma Central—is rapidly converting to diesels. Oil storage tanks will be supplementing or supplanting the coal storage piles at many ports in the future. The writer recently saw such a development at Michipicoten Harbour, Ontario, on Lake Superior.

A steady increase in the use of electricity has required power companies to expand existing plants and build new ones. In the Great Lakes region it has been economically desirable to make these additions along the shores of the Lakes whenever possible. The mounting consumption of coal by utility companies is indicated in Table IV for the two largest power producers in Michigan —a state nearly surrounded by the Great Lakes. The increase in lake coal receipts over the decade by nearly 3.5 million tons or 163 per cent by the two utility companies is a good indication of the contribution of this business to the lake coal trade. A number of expansion projects now in progress along the Lakes by these and other companies

TABLE IV

RECEIPTS OF COAL BY CONSUMERS POWER AND DETROIT EDISON: 1940 AND 1950[a]

Year	*Total (tons)*	*Via Great Lakes (tons)*	*Per Cent via Lakes*
1940	2,697,400	2,108,800	78
1950	7,166,000	5,534,600	77

[a] Data provided by Mr. C. H. Purdy, Consumers Power Company and Mr. M. Pease, Detroit Edison Company.

can be expected to add considerably to the coal traffic on the Lakes in the near future. For example, a power plant being built on the St. Clair River will ultimately use about 2.5 million tons of coal per year.

The state of Michigan received by lake carrier about half (48 per cent) of the 28.8 million tons of bituminous coal it consumed in 1947.[12] A look at any resources map of America will show a coal basin within the state, and this raises a question as to the reason for such vast imports of coal. The volume of this fuel mined in the state is practically nil, however, because the reserves lie so deeply buried and are in seams too thin to warrant development at present. Also the sulphur content is high. Back in 1901, however, lake shipments of coal from the Saginaw River reached 645,000 tons. Today about three times this volume enters at this point annually from other fields.[13]

SOUTHERN LAKE MICHIGAN DEVELOPMENTS

The coal trade in southern Lake Michigan has several features which are of especial interest. One is the relatively small volume of lake coal

[11] Letter from Mr. J. F. Moriarty, Fuel Purchasing Agent, Canadian Pacific Railway, Montreal.

A factor influencing the railway's increasing use of oil for fuel is its ownership of lands in the Alberta petroleum fields. The writer understands that it has been found preferable to utilize some of this resource rather than to receive royalties on all of it which in turn would show as profit and result in additional taxes for the company.

[12] Data based on a report prepared by the writer when he served as chief of the Research Division, Michigan Department of Economic Development, Lansing.

[13] For a survey of the traffic of this and other important Michigan ports see Albert G. Ballert: "The Major Ports of Michigan," *Papers of the Michigan Academy of Science, Arts and Letters*, Vol. 35, 1949, pp. 137–157.

shipped into the Chicago-Gary iron and steel district—about 3.1 million tons in 1950. Particularly unusual are the Gary receipts of only 37,945 tons that year. In 1949, 666,820 tons of lake coal were received. In view of the recognized savings on coal received by the rail-lake route, the little use made of bulk carriers appears unsound. The cause of this situation, however, is an insufficiency of ships. Were U. S. Steel vessels (Pittsburgh Steamship) available or other carriers obtainable for charter, the transportation of coal from the Appalachian fields would be at least in part by the rail-water route. The company's present fleet must operate between lakes Superior and Michigan in order to build up adequate stock piles of ore for the period when navigation is closed. Bulk carriers now under construction will likely relieve this situation and should result in substantial coal receipts at Gary.

The volume of coal used by the U. S. Steel plants at Gary and South Chicago in a year provides an indication of this potential addition to the lake coal trade. It amounts to 7–8 million tons and moves principally by rail from the Appalachian fields. Coking ovens are located at Gary and Joliet. Mention has been made in articles and texts of the mixing of some Illinois coal with the eastern coal, but this procedure is no longer followed. That the largest steel mill on the Great Lakes will receive a much larger proportion of its

FIG. 4. Unloading a freighter at one of the 19 coal-handling docks at Duluth-Superior. Other storage docks appear in the background. Normal stocks maintained here constitute one of the nation's largest reserves of prepared coal. Considerable quantities are used by the railroads and local industries (including two briquette manufacturing plants), but the bulk of the coal is forwarded by rail to consuming centers in Minnesota, Wisconsin, and the Dakotas. (Courtesy of Duluth Chamber of Commerce.)

coal via the Lakes before long seems a certainty, although the need for a cargo for vessels en route to the Lake Erie coal ports presents a problem.

Another large consumer of coal at the southern end of Lake Michigan which might be expected to utilize lake shipping is the Commonwealth Edison Company of Chicago. While about 4 million tons of coal were received in 1950, the entire tonnage was obtained by barge via the Illinois Waterway. This steam coal is mined in central Illinois. Not a ton of lake coal was received along the Chicago River and its branches.

A review of Milwaukee's lake coal receipts over the first half of the century shows present bituminous tonnages below the early years and anthracite markedly decreased. The latter's decline is a general condition (Fig. 2), but in the case of soft coal the reason is one of competition to the extent that it has offset the increasing fuel demands of population and industrial expansion. There are several reasons for this condition: (1) revision of the rate structure on coal to interior points has favored Duluth-Superior as a distribution point, with the area served by Milwaukee now largely in the portion of Wisconsin south of Eau Claire (about 30–35 per cent of the lake receipts move to inland points), (2) extension of natural gas lines to Milwaukee several years ago, and (3) movement of Illinois, Indiana, and western Kentucky coal to Milwaukee largely by all-rail routes. A power plant being built about two miles south of Milwaukee will, however, utilize waterborne coal from the above-mentioned fields at the rate of about 2 million tons per year.[14]

[14] Mr. H. C. Brockel, Port Director, Board of Harbor Commissioners, Milwaukee, provided most of the facts about the port.

A proposed port development on southern Lake Michigan should be mentioned here, inasmuch as coal has thus far been suggested as the major item of traffic. This project, Burns Harbor, is situated between Gary and Michigan City, Indiana. At present the Hoosier State does not have a public commercial harbor on the Great Lakes, but the soundness of the proposed venture, from an economic standpoint, appears highly questionable. Such matters as (1) securing significant quantities of coal for transshipment (only about 5 per cent of the 2.5 million tons of coal presently shipped at nearby Calumet River originates in Indiana), (2) controlling coal dust in loading vessels where other harbor occupants are nearby, and (3) benefits vs. costs are some of the relevant problems to this proposal. The prospective annual volume of coal for transshipment at the southern end of Lake Michigan does not provide a substantial reason for developing a port and installing loading facilities here.

ST. LAWRENCE TRAFFIC

The potentialities of the proposed St. Lawrence Seaway for the future coal trade of the Great Lakes provide an intriguing subject with which to conclude this survey. The volume of this commodity estimated to move through the enlarged St. Lawrence route is not set very high even by the waterway proponents—4 million tons annually.[15] In 1950 the through and way traffic of bituminous coal from the United States to Canada on the St. Lawrence canals totaled 2,270,365 tons.[16] The annual tonnage of hard and soft coal imported

[15] U. S. Congress, House, St. Lawrence Seaway, Part I (82–2), Hearings before the Committee on Public Works, 82d Cong., 1st Sess., Feb.–Mar. 1951, p. 7. The estimate was made by the U. S. Dept. of Commerce.

[16] Dominion Bureau of Statistics, *Canal Statistics, 1950*, Ottawa, 1951, p. 33. There was no anthracite in the traffic.

into Quebec in recent years has averaged 5 to 6 million tons.[17] This province will continue to be the only significant recipient of coal through the St. Lawrence even if the waterway is improved. Overseas trade in coal from Great Lakes ports would appear highly illogical inasmuch as Atlantic ports are as near or nearer to the coal fields and the present high volume of this commodity being shipped to Europe cannot be expected to continue beyond the life of ECA or some similar program. With the opening of the Labrador iron ore range it might well be expected that a greater share of Quebec's imported coal will be received by water in ships returning from American ore-receiving ports. The proportion of this ore which moves to Atlantic and Great Lakes ports will influence the routing of the coal. Since the ore field will be in production before the St. Lawrence Seaway can become a reality, the volume of coal from the Great Lakes to the Quebec market will not be altered upward in the near future, but the reverse may become true. With the commodity routing pattern once established, it is not apt to be grossly altered later. Hence, the St. Lawrence–Atlantic Seaboard trade should not be markedly changed by the St. Lawrence Seaway if and when it is developed.

CONCLUSION

From the facts and trends which have been presented, it appears that the Great Lakes coal trade holds good prospects for the future. This traffic, incidentally, does not show the degree of fluctuation which is found from year to year in the ore movement. Whereas bulk carriers currently may return to upper lakes ore ports in ballast, the reverse may become true in the future with the import of more overseas ore.

A principal market for additional lake coal in the future is the utility companies.[18] This expanding activity should bolster both Lake Erie and Lake Michigan shipments until such time as atomic power may be generally utilized by generating equipment. Steel plants also can be expected to contribute further to an increasing flow of coal over the Lakes. Expansion programs are underway at most plants using lake coal. The Detroit area is one which is particularly low in iron and steel production in light of its great market in the nearby territory. This area should make substantial gains accompanied by a need for more coal. The construction of new bulk carriers and conversion of ocean vessels for use on the Lakes will mean a significant expansion in the annual transport capacity of the Great Lakes fleet.[19] Even the decline in the railroad fuel market may not be permanent for developments in the use of powdered coal in steam turbine engines may strengthen this outlet.

Note: Preliminary statistics for 1951 show the bituminous coal shipments from Great Lakes ports totaling 50.3 million tons or 13 per cent below 1950. This resulted from a decline of about 8 million tons in Lake Erie shipments. Anthracite shipments totaled 519,000 tons in 1951.

[17] Dominion Bureau of Statistics, *Coal Statistics of Canada, 1949*, Ottawa, 1950, p. 57.

[18] It has been estimated that the use of electricity will double in the next ten years (A. A. Johnson, Westinghouse Electric Corp., *Wall Street Journal*, October 5, 1951).

[19] During the period 1951–53 about twenty-five vessels will be commissioned, having an aggregate carrying capacity of more than 400,000 gross tons. Based on data in the *Annual Report of the Lake Carriers' Association, 1950*, pp. 50 and 60.

A NEW PROJECTION FOR CUBIC SYMBOLS ON ECONOMIC MAPS

J. Ross Mackay

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ALTHOUGH everyone knows that a sphere cannot be perfectly represented on a plane surface, a surprisingly large number of people tend to forget that the same statement also applies to all solid forms, cubes included. It is no more possible, and no more desirable, to "draw a cube" without any reference to its projectional properties than it is to do the same with a sphere.

The choice of projection involves far more than mere academic interest, because it is of considerable practical importance. The projection which is used on a map determines whether the cubic symbols resemble cubes, whether they are simple or difficult to compare, and whether they are easy or hard to construct. Since only three volumetric symbols—spheres, block piles, and cubes—are commonly used on economic maps to show extreme variations in distributional data, the study of one of them is of importance. In the following discussion, the purpose is to analyze some of the problems involved in the use of cubic symbols.

Projections for Cubes

Whenever cubic symbols are drawn in two or more projections on a map, it is futile to attempt comparisons in size. It is axiomatic that the symbols should vary only in size and not in shape. In order to ensure uniformity of shape, all the cubes must be drawn according to the same rules of projection.

The isometric projection, with front and sides of equal length, is frequently used for representing cubes. The cabinet projection, with sides half the length of the front and inclined 30° to 40° from the horizontal, is much less popular. Perspective blocks can be drawn, but lack of perspective does not seem displeasing in a cubic symbol. In addition, perspective cubes are somewhat complicated to draw. The clinographic projection, which is used for precise drawings in crystallography, is seldom if ever used on economic maps.

Certainly one of the first considerations which should govern the selection of a suitable projection for cubic symbols is how closely they resemble the solid form of a cube. Each projection attains this desirable result in greatly varying degree. The obvious way to study this problem is to draw cubes in different projections and then test them experimentally to determine the reactions of people to them.

Cubes drawn in three projections were tested on two groups of college students. Group A, with 25 students, had some previous experience in drawing block diagrams and cubes, whereas Group B, with 75 students, had none. Group A showed a high percentage in favor of the cabinet projection (62 per cent), followed in order by the clinographic (30 per cent), and isometric (8 per cent). The selections of Group B were: isometric (64 per cent), cabinet (36 per cent), and clinographic (0 per cent).

The results showed an overwhelming preference of Group A for "thinner" projections than Group B. Since the differences in preference can only be attributed to training, it is evident that one projection cannot be best for all purposes. Furthermore, "thick" cubes seem to appeal more to the untutored than "thin" ones.

A second test was devised in order to determine what ratio of side to front gave the most pleasing resemblance

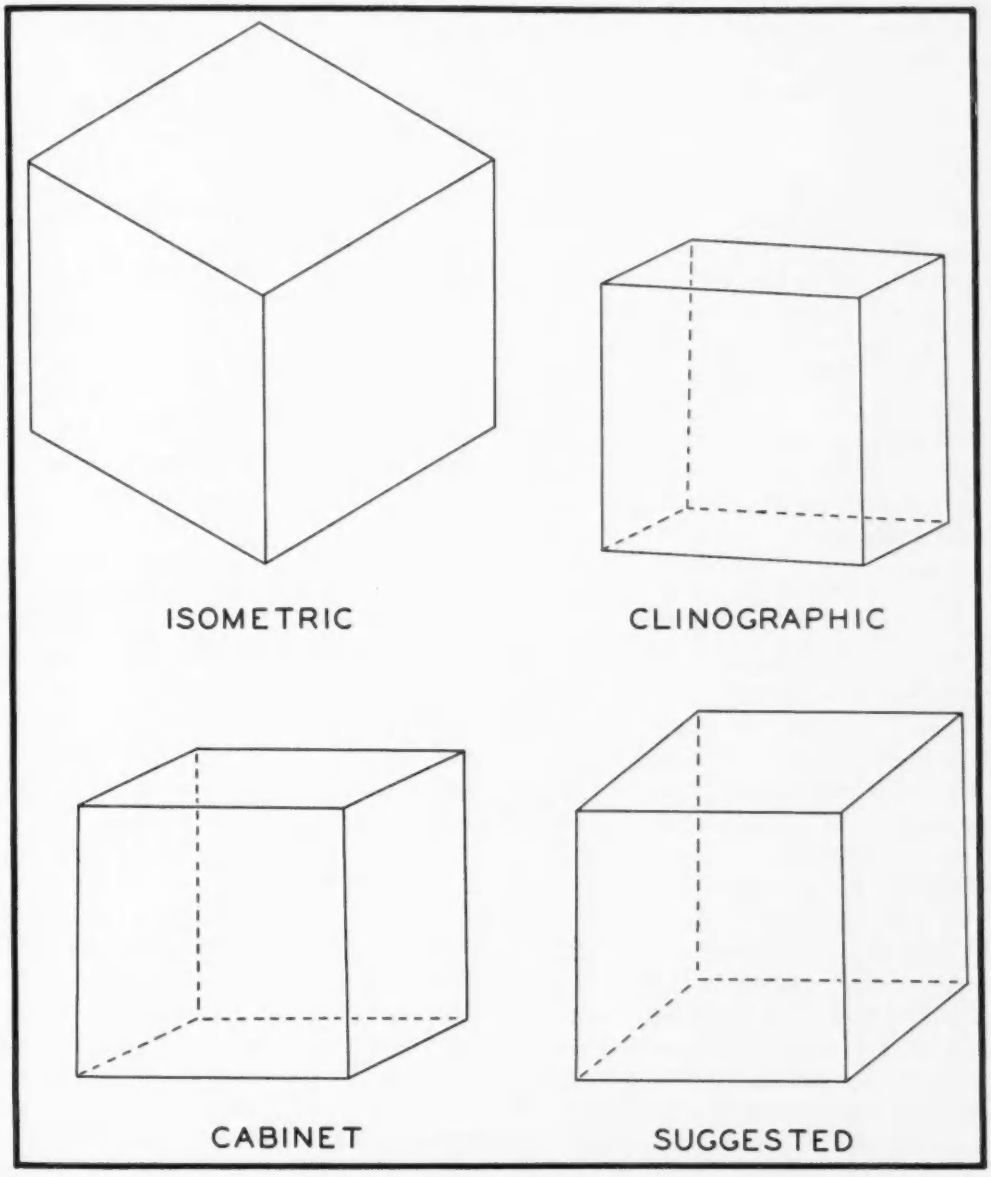

Fig. 1. Cubic symbols are shown in four different projections. Wherever possible, the "front" faces of the cubes have been drawn with their sides of equal length. Note how greatly the symbols vary in their resemblances to the solid form of a cube and how some take up much more map space than others. The isometric projection is one of the best all-round projections. The suggested projection for those familiar with volumetric analysis has sides 3/5 the length of the front and inclined from 30° to 50° to the horizontal.

to a solid. For this purpose, eight incomplete cubes were drawn. The fronts were square and viewed face on. Parallel sides were drawn at angles of 10°, 20°, 30°, . . . 80° to the horizontal. The students completed the cubes by blocking in the two omitted back lines (one vertical, one horizontal) so that each completed cube looked to them like the best representation of the solid form. Once again, Group A favored "thinner" cubes than Group B. The average ratio of side to front for Group A was about 60 per cent when the sides were inclined 30° to 50° from the horizontal. The corresponding ratio for Group B was almost 70 per cent. Both groups preferred sides inclined about 30° to 50° from the horizontal.

Most cubes, with the exception of those in the isometric projection, are viewed face on and with either a right or left side showing. Almost all of the students favored a right view over a left one.

COMPARING CUBES

A frequently expressed criticism of all three-dimensional symbols, cubes included, is that they are extremely difficult to compare. Although the general criticism is fair, it is much too broad and inclusive. It is like saying that isopleths are hard to interpret, without adding a qualifying statement "for the beginner." It is quite true that people unfamiliar with the problems of volumetric comparisons tend to greatly underestimate ratios, but it is equally true that people familiar with the problems can estimate them reasonably accurately, especially with the use of a map legend. As an illustration, the results for volumes estimated by Groups A and B are shown below. The actual and estimated sizes are expressed in arbitrary units.

Projection	*Actual Size*	*Estimated Size*	
		Group A	*Group B*
Clinographic.....	16	12.1	8.1
Cabinet.....	16	13.7	8.3
Isometric.....	16	15.2	9.2
Clinographic.....	4	3.5	2.7
Cabinet.....	4	3.6	2.8
Isometric.....	4	3.8	2.9

Familiarity with the construction of cubes is clearly evidenced by the consistently higher accuracy of Group A over Group B. When Group A was given a little training in volumetric comparisons, the accuracy was greater than that given above. In all the tests, the errors were greatest with the clinographic projection and least with the isometric. The reason seems to be that many people compare areas, rather than volumes, when the cubes are too "thin," as in the clinographic projection.

CONCLUSIONS

The particular projection used on an economic map should be selected to meet the needs of the potential map readers. The popular isometric projection is not the best for all purposes. It is certainly one of the best for map users who lack training in volumetric analysis.

A new and suggested projection for trained people is one with a square front, sides inclined 30° to 50° from the horizontal, and sides 3/5 the length of the front. A right sided view should be given. The projection is easy to draw, shows a good resemblance to the solid form, and can be compared relatively accurately.

The objection that cubes are difficult to compare is true only for those map users without training in volumetric analysis. Most people, trained and untrained alike, are more accurate when they compare relatively "thick" cubes than "thin" cubes.

SUGAR CANE AND TOBACCO: A COMPARISON OF AGRICULTURAL TYPES IN THE HIGHLANDS OF EASTERN PUERTO RICO

John P. Augelli

Dr. Augelli was Associate Professor and head of the Department of Geography at the University of Puerto Rico from 1948 to 1952. He is currently associated with the Department of Geography at the University of Maryland.

THE highland region of eastern Puerto Rico has adapted the resources of its soil and climate to the production of two types of agricultural crops. First, there are products grown for export to obtain "exchange" for the purchase of commodities not produced on the island. Sugar, tobacco, and, to a much lesser degree, coffee fall into this category. These export crops yield a high monetary return per acre, a feature of the economy that is especially significant in a densely populated area where natural resources are scant. Second, products that yield a high return per acre in terms of food value are raised for consumption on the farm and for limited sale on the island. These crops are composed of a variety of vegetables and fruits which collectively are called *frutos menores*. They include corn, rice, beans, yautía (dasheen), plantains, sweet potatoes, yams, pigeonpeas, and cassava.

This production gives rise to a two-fold division of agricultural types: sugar cane farming on the one hand and tobacco-food-crop agriculture on the other. The distinction between the two is not always clear-cut. They have many characteristics in common, and often they are found side by side on the same farm. However, the distinction exists, and it is reflected in both the economic and social structure of the region.

Cane agriculture is characterized by large farms occupying the best soils in the area, the level alluvial bottoms and the gentle slopes. (See Type Area, Fig. 2.) Tobacco and food crops are typically raised on small farms where slopes are steep and soils have a low fertility rating. Cane farms are never far from railroad or highway facilities, whereas tobacco and minor crops may be grown even in the most inaccessible crannies. Cane farms are seldom self-sufficient in labor requirements, and, especially during the cutting season, must procure a large labor force. Labor on tobacco and food farms is generally supplied by the farmer's family, extra help being hired only in the case of the larger farms.

Sugar culture is characterized by single crop production while tobacco has multiple-crop production.[1] Cane farming surpasses tobacco in the amount of capital invested, in the income from crops, and in progressive agricultural techniques. The sugar men as a class are wealthier, better educated, socially more prominent, and more disposed to try new methods than are the tobacco farmers. Sugar agriculture has fewer *medianeros* (share croppers) and more absentee ownership; it is more inclined to the patterns of tropical plantation

[1] Many farms which specialize in sugar, however, may raise tobacco and food crops on their poorer and more sloping land (Fig. 3).

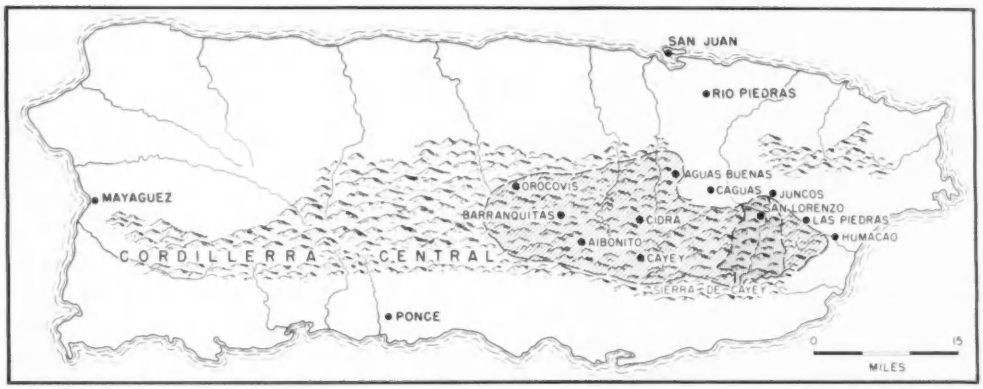

FIG. 1. Place map showing, by pattern of diagonal lines, the limits of the Eastern Highlands, and, by vertical lines, location of the type area portrayed in Figure 2.

agricultural than is tobacco-food-crop farming. Sugar is exclusively commercial while tobacco and food crops are semi-subsistent, the production of food crops for home use being as important as the tobacco growing. Finally, the two types may be distinguished by the buildings associated with each. Tobacco has the drying shed or barn on the farm and the warehouse in town; sugar cane claims the *central* or sugar mill.

But the two agricultural types have several important similarities. Both are high cost producers. This is due to the low fertility and worn-out condition of the soil, the lack of mechanization, and inefficiency of labor. Both types lean heavily upon government aid and subsidies and upon relatively primitive tools and agricultural methods. Both have production restricted by quota systems, and in both animals are relatively unimportant.

Both agricultural types are intensively developed. Over 90 per cent of the land in the eastern highlands is in farms. Of this total about one-third is in crops, one-third is permanent pasture, and the remainder is in pasture, woods, urban, and other uses.[2] (See Type Area, Fig. 2.)

[2] U. S. Census 1940; Records, Production and Marketing Administration.

TABLE 1*

AVERAGE YIELDS, LABOR REQUIREMENTS, COST OF MATERIALS, AND GROSS INCOME PER CUERDA (0.97 ACRES) OF SUGAR CANE AND TOBACCO IN THE HIGHLANDS OF EASTERN PUERTO RICO (1949)

Crop	*Yield*	*Man Hours of Labor*	*Cost of Materials*	*Gross Income*
Tobacco	800 lbs.	800	65	$185.00
Cane	26.5 tons	400	35	240.00

*Sources: (1) Field Interviews of 300 farms; (2) Unpublished labor requirement studies of P. R. Agricultural Exp. Station: and (3) Production and Marketing Adm. Reports.

The structure of both agricultural types is further characterized by a large number of small farms, by an oversupply of labor, and by some absentee landlordism.

PRODUCTION STRUCTURE OF CANE FARMING

Sugar Cane was introduced into the highlands of eastern Puerto Rico in the eighteenth century, but its cultivation remained insignificant throughout the period of Spanish occupation. The interest taken by Americans in the crop resulted in a modest expansion after 1898. In most of the *municipios* of the region land in cane doubled between 1900 and 1930.[3] However, lack of level land and poor transportation made the

[3] U. S. Military Census, Puerto Rico, 1899; U. S. Census 1910, 1920, 1930.

highlands more suitable for tobacco than for cane. As long as the demand for tobacco remained strong, sugar cane was grown on a small scale. Only the most fertile bottom lands along the highways were planted in cane during the height of the Tobacco Era (1898–1932). Elsewhere the crop could not compete with tobacco.

After 1932, two factors brought cane to its currently strong position in the agriculture of the highlands: (a) the demand for sugar created by the war; (b) the decline of tobacco. When the war created large demands for sugar, the quota restrictions were eliminated. As a result, hundreds of farms which previously had not been permitted to raise cane came into production. The quota system re-established after the war allowed these new producers to remain in operation.

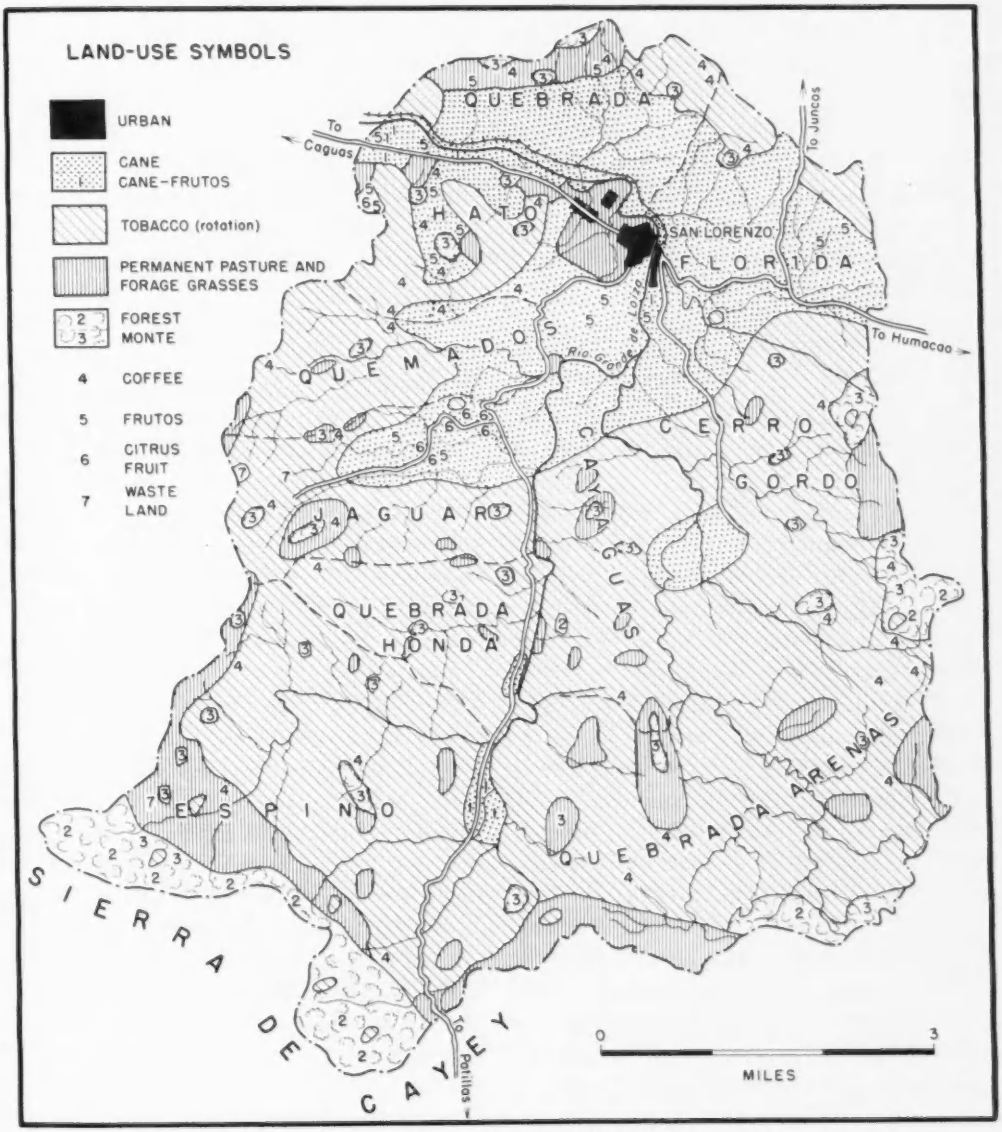

FIG. 2. Land use in a typical municipio (San Lorenzo).

In a typical *municipio* of the region (Fig. 2), cane land rose from 917 cuerdas in 1930 to 1928 cuerdas in 1940. By 1950 increases which had originated with wartime demands and had continued with the postwar Marshall Plan had established a high of 3591 cuerdas. Sugar spread from its traditional level sites to adjoining slopes, occupying land which previously had been considered too steep for cultivation. It crept southward along the narrow river valleys, occupying every small patch of flood plain, and reaching even to the "divide" lands along the Sierra de Cayey. The number of farms producing cane in the eastern highlands more than doubled between 1930 and 1950, and the spread of the crop continues. Its only check is set by restrictions beyond the farmer's control.

FACTORS AFFECTING THE PRODUCTION STRUCTURE OF SUGAR CANE

The factors which affect the production structure of cane in the eastern highlands may be divided into three groups: (1) political, under which come the production quota and the government subsidy; (2) physical, which includes topography, climate, and soils; (3) cultural, under which are included agricultural practices, transportation costs, credit facilities, and labor costs.

The over-all production of sugar is limited by a quota set by the United States Department of Agriculture. Only that sugar produced within the assignment is assured of a market. Extra-quota production runs the risk of not finding a market. Currently Puerto Rico is assigned a quota of 910,000 tons for export to the United States and 95,000 tons for local consumption. Assignment of the quota to individual farmers is accomplished on the basis of such factors as farm size, potential production, and history of production.

Associated with the quota is a subsidy varying between 52 and 80 cents per hundredweight of sugar produced. This subsidy is scaled to favor the small producer, but all producers receive some compensation. Eighty cents per 100 pounds is paid for the first 7500 cwts. Above this figure a sliding scale is applied, but no producer receives less than 52 cents per hundredweight. The subsidy is paid by the United States government, supposedly to compensate for the limitations set by the system. The importance of this subsidy is well illustrated in Table II. In an area of marginal production such as the eastern highlands, cane farming would be almost impossible without this compensation.

The physical factors are especially significant for the influence they exert on yields. Each of the more important elements (topography, climate, and soils) seems to exert a particular influence, although the over-all yields, of course, depend upon the interplay of all.

Other factors being equal, cane planted on slopes will yield less per cuerda than that planted on level lands. This is due to poorer soils, more erosion, and greater loss of fertilizer to rain wash on the slopes than on the level lands. However, the sucrose content of cane raised on slope land is higher than that of the plain. This seems to be the result of better drainage on the former than on the latter. Once the cane has matured, water affects its sucrose content inversely. This point is well illustrated, by the sharp lowering of sucrose if there is excessive rain immediately prior to the harvest. But the higher sucrose for slope land is not sufficient to offset the lower cane yields, and slopes are not planted to cane, unless there is no other alternative.

The influence of climate on cane is exerted primarily by temperature and precipitation. It is estimated that cane

TABLE II

BALANCE SHEET OF A TON OF CANE FROM THE EASTERN HIGHLANDS (1948)

One Ton of Cane

YIELD

223 lbs. of sugar — 5.4 lbs. molasses

78 lbs. to central — 145 lbs. to farmer — 2.7 lbs. to farmer — 2.7 lbs. to central

INCOME		$8.74
COSTS		
Cultivation	$3.09	
Land	.29	
Fertilizer	1.42	
Harvesting	1.30	
Transportation	.91	
Credit Cost	.31	
Other	1.41	
Total		8.72
PROFITS		$0.02
FEDERAL SUBSIDY		1.16
TOTAL PROFITS		$1.18

ceases to grow if temperatures drop below 60° F. It is also known that some correlation exists between temperature above 60° F and cane yields, but detailed studies of such correlations are lacking in Puerto Rico.

Checks made on temperature and cane yields in the region suggest, although not conclusively, that the higher the average temperature, the higher the yields. Considering all possible factors, the yields of lands below 500 feet were above the regional average, whereas those above this height fell below the average. In addition, it was found that there is a correlation based on climate between cane yields and the harvest month. A check made upon this tendency indicated that, other factors being equal, the yield of cane harvested at the beginning or end of the cutting season is lower than that harvested in the middle of the season. The yields seem to increase constantly from January to a peak in May and then to drop during June and July.

Since total precipitation in the eastern highlands is everywhere sufficient (above 60″) for cane growth, it is the distributional aspect of rainfall that most affects crop yields. Abnormal distribution during any part of the growing season will probably affect yields adversely, but the most dangerous period is the harvest season when the cane has already reached maturity.

The cutting season (January to July) is normally dry. Reduced precipitation facilitates the cutting and transporting of the crop, and it helps to maintain sucrose percentages at their highest. Excessive rains during this period in-

crease the weight of cane but reduce its sucrose content.

Soil types are also of some significance to cane yield. Alluvial soils in general have higher yields than the slope soils which are also used for sugar cane. However, the difference in yield due to natural fertility can be largely offset by the addition of larger amounts of fertilizer and by other agricultural practices.

In the cane fields of the highlands the amount of fertilizer added to the soil varies between 800 pounds and a ton per cuerda. In addition, the more prosperous farmers use a ton or two of lime per cuerda about once every five years. The over-all amount of fertilizer used seems to depend upon the wealth of the farmer. Larger and more prosperous farms always use more and obtain better yields. Probably the high cost of fertilizer accounts for this practice. Currently, lime sells for $3.00 per ton plus delivery charges. The other fertilizer used for cane costs $57.25 per ton at the factory.

Other factors which explain the lower yields for the smaller and generally poorer farms are poorer soils, less labor, less *gran cultura* cane, and the use of too many ratoons.

The number of ratoon crops which the land can produce is generally the most important factor in determining the farmer's profits. With rising labor costs, the expense of replanting a new crop is so great that a farmer can afford to replant only a small percentage of his land each year. The Eastern Sugar Associates, operating in the region, estimate that it costs $286 to produce a cuerda of *gran cultura* (first planting) and $82 for a cuerda of ratoon.

Since ratoon growth is subject to a law of diminishing returns, the number of crops produced will be determined by the balance between reduced yields and the cost of replanting. The yields in turn depend upon natural soil fertility and the amount of fertilizer used. The better lands in the region produce an average of eight to twelve ratoons. Yields on the poorer farms hardly justify harvesting as many as four ratoons, but labor costs often force production of six or more crops in spite of low yields.

In addition to agricultural practices, other cultural factors which vitally affect the production structure of cane are transportation costs, credit facilities, and labor costs.

The cost of transporting cane from the farm to the mill is theoretically assumed by the central. It is one of the services rendered for the 35 per cent "cut" of the farmer's sugar which the central retains as a fee. However, in practice, differences in transportation facilities and accessibility result in additional costs which the farmer himself must assume.

Specific examples of this variation in transportation costs are well illustrated by the differences encountered in a typical *municipio* (Fig. 2). The farms in Barrio Quebrada which are located east of the river and north of the town have access to a railroad spur which connects with the Central Santa Juana in Caguas. The farmers here pay only the cost of transporting their crop from the fields to the line. The central assumes the cost from there on.

In the remainder of the *municipio*, the cane must be transported by truck. The farmer pays all expenses for the truck haul and is then reimbursed by the central at the rate of 15 cents per ton plus four cents more per kilometer ton. If the farmer owns his own truck and has easy access to the highway, this compensation covers most of the cost. If the farmer must hire a truck, the extra costs may run to over 25 cents or more per ton. Costs are especially

high for farms lying east of the river and south of the town in Cayaguas, Quebrada Arenas, and Espino. These farms have no connection with the Juncos and Humacao highways and have no bridge to cross the Loiza to the Patillas road (Fig. 2). As a result, the farmers must ford the river by ox cart or must use trails to get to the highways, banks, from the Puerto Rico Production Credit Association, and from other agencies. The findings of Morales and Haddock in a credit study of 347 sugar farms on the island as a whole helps throw some light on the situation in the region. They found that: (1) Ninety-six per cent of all sugar farmers depend on credit for production; (2) The

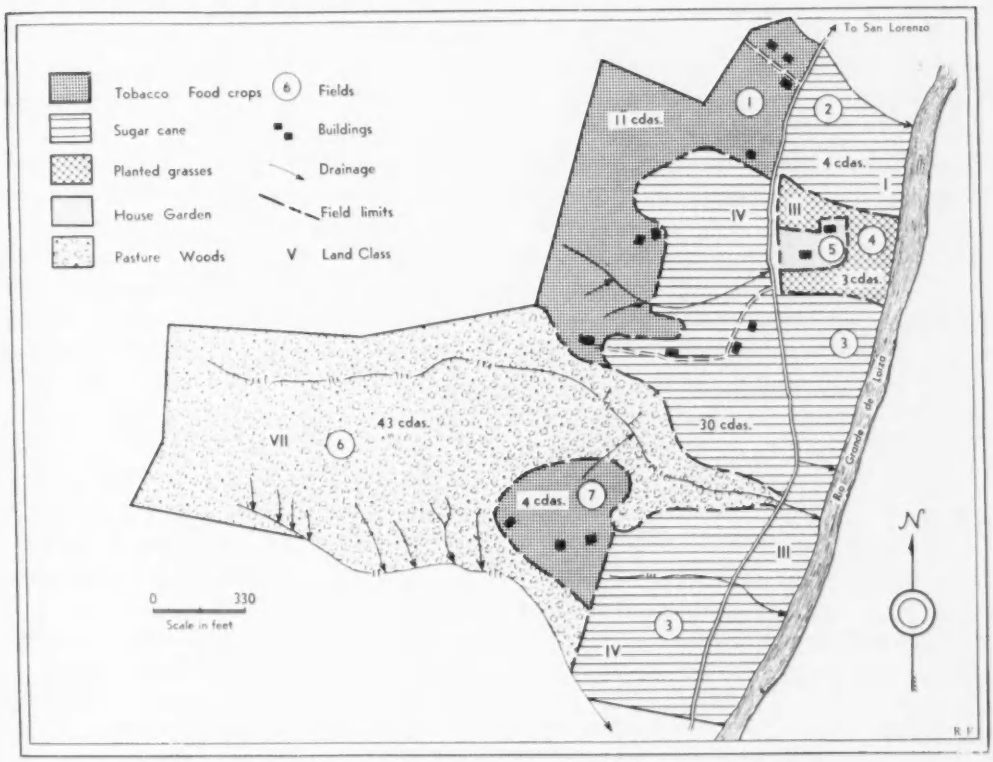

FIG. 3. Finca Juan Muñoz, a sugar farm of the Eastern Highlands.

thus greatly adding to costs. Elsewhere in the area where slopes are too sharp to permit entrance by truck, the cane must be hauled down to the roads by ox carts and even by human porters.

Credit is indispensable in the production structure of sugar in the eastern highlands of Puerto Rico. Probably every farmer borrows on his crop, but the credit facilities are not uniform. Usually the small *colonos* (farmers) borrow from the big ones, and the big ones borrow from the central, from average amount borrowed per cuerda of cane was $69.00; (3) The rate of interest paid on loans varied between 4 and 9 per cent.[4]

Last but not least of the factors affecting the production structure of sugar cane is labor cost. Since the passage of the minimum wage law for cane workers in 1941, the cost of labor on sugar farms has risen sharply. A

[4] J. O. Morales and D. Haddock: "A Credit Study of 347 Cane Farms in Puerto Rico (1939–40)" *Agr. Exp. Sta. Bulletin No. 70*, Rio Piedras, P. R., 1940.

field hand now earns from $2.00 to $3.00 per day. Prior to the passage of the law, agricultural labor could be obtained for $1.00 per day or less. In spite of every effort to keep costs down, lack of machinery, low labor productivity, and the forced minimum wage makes labor by far the largest item in the cost of production (Table II).

The labor situation in the eastern highlands (as in all of Puerto Rico) presents a strange paradox. There is an oversupply of workers, yet labor costs are generally considered too high. Any attempt to reduce these costs by importing machinery is fought tooth and nail, not only by the laborers themselves but by every well-meaning social and political organization in the island. Yet everyone is aware that the continued high cost of cane production as compared with costs of potential competitors (Cuba, Louisiana, Hawaii) is like a sword of Damocles hanging over the economic life of the island.

TOBACCO

It is too early to determine whether tobacco production in the eastern highlands has reached its lowest ebb. In the years since the Depression struck the industry a heavy blow several trends have become apparent. First, the relative importance of tobacco in the agriculture of the area has been decreasing, but it continues to be the leading cash crop for the vast majority of the population. Second, wherever transportation and physical conditions permit, sugar cane is displacing tobacco. Third, most small farmers have reduced their production in accordance with the quota to a point where they feel it is impossible to keep going, unless they have other sources of cash income. Fourth, with tobacco production either continuing to decrease or remaining fixed at the present level, the increasing population of small farmers is hard pressed to find a source of cash income. One of the most serious socio-economic problems of the region revolves around the question, What is to supplement tobacco as the cash crop of the semi-subsistent mountain farmer?

For the 1948–49 season, the tobacco quota assigned to the region was roughly 25,000,000 pounds. The results of dividing this quota among thousands of small producers were: (1) Over 90 per cent of the farmers produced less than one ton of tobacco each; (2) More than one-third of the total were assigned the quota minimum of 400 pounds; (3) Less than 1 per cent produced 10 tons or more.

Where the quota permits, tobacco cultivation has few limitations. It is grown on the sharpest slopes, the poorest soils, and in the most inaccessible locales. Compared with sugar cane, tobacco is a shallow-rooted crop, and it will grow and produce fair yields even on the shallow soils of slopes with inclinations of 50 per cent or more. The crop is grown on practically all the soil types and phases in the region, but the forte of production is based upon the Mucara, Cayagua, and Jayuya groups.

Tobacco is one of the very few crops which can be profitably transported to market from the more remote farmlands of the area. In mountainous terrain where transportation still leans heavily upon the horse, the ox cart, and the human porter, the cost of transportation is so high that it limits the export products. Tobacco, which has a high value per unit of weight, which does not spoil easily once it is dried, and which requires no costly equipment to handle, meets the requirements of expensive transport.

For most of the highland farms, tobacco is the keystone upon which hinges the entire agricultural structure. Since it is the only cash crop, it largely determines the money income that the

TABLE III*

Year	*Stocks on Hand in Pounds*[1]	*Quota Assigned*	*Actual Production*	*Sale*
1946–47	78,295,000	25,000,000	23,049,000	27,338,000
1947–48	74,000,000	24,000,000	26,105,000	32,088,000
1948–49	68,023,000	24,800,000	27,000,000	41,886,000
1949–50	53,137,000	25,000,000	.....	.....

*Records of the Instituto de Tabaco, P. R., Dept. of Agriculture.
[1] Note the influence of the quota (established 1946) in reducing the stock piles of tobacco.

farm family will have. But equally important, in an indirect manner, tobacco determines the amount of food crops which a farm can raise for the subsistence of the family. Fertilizer is too expensive to apply to subsistence crops. Therefore, most food crops must rely upon the fertility left in the soil after the tobacco is harvested. The larger the tobacco quota, the more fertilized fields available for food crops there will be.

FACTORS AFFECTING PRODUCTION, YIELDS, COSTS, AND PROFITS OF TOBACCO

The over-all production of tobacco is set by the tobacco quota which, in turn, is governed by market possibilities in Puerto Rico and the United States. Unlike the sugar quota, which is a federal limitation, the tobacco is an insular limitation. The tobacco quota was established by the Insular Department of Agriculture with the consent of most of the producers. After the Depression, the strongly fluctuating demand and price for tobacco made production controls necessary. In 1946 the insular government passed Law 455 (*Ley de Cuotas de Tabaco*) in an effort to ease the tobacco problem. Since this date production has been controlled, and to a large extent undisposed reserves are being reduced to the point where supply is approaching demand.

The average cuerda of tobacco in the eastern highlands yields 800+ pounds of tobacco; it requires from 700 to 1000 man hours of work and about $65 in fertilizer and other materials; and it yields a gross income of about $175 and a profit of from $50 to $75. But these averages do not reveal very much if one considers the nature of tobacco and contrasting physical and cultural detail of the region.

Tobacco is an extremely sensitive plant. It responds to minute differences in physical conditions, agricultural practices, and methods of handling after the harvest. Every step in the production structure from the selection of the seed to the final curing affects the quality and may affect the quantity. The factors which affect yields, costs, and profits stem from these variations.

The tobacco soils of the eastern highlands are so completely worn out that yields are essentially determined by the amount of fertilizer used. Variation in soil type is of little significance. The average yield of 800+ pounds per cuerda so common in the area can be easily raised to 1200 pounds or more simply by increasing the amount of fertilizer.

In turn the amount of fertilizer used is determined by the wealth of the farmer. It is not uncommon for the more prosperous farms to use twice as much fertilizer as the poorer farms and consequently obtain almost twice the tobacco yields. With fertilizer selling at $3.25 per hundredweight in the towns, the poorer farmer tends to use a

minimum. This is especially true if his farm is remotely located since the cost of transportation increases the cost of fertilizer still more.

Climate and disease also play a significant role in tobacco production. Weather changes can affect the crop at any time during growth and curing, but there are two periods when they are especially important. These come during the early stages of growth and during the drying and curing period. The young tobacco plant whether in the seed bed or during the first weeks of growth is susceptible to weather abnormalities of all types. Driving winds and rain, excessive temperatures and exposure to the strong rays of the sun, and inadequate rainfall can all cause damage or affect the quality of the tobacco. Similarly, excessive rains during the curing period detract from the quality. Tobacco is planted at the end of the rainy season in order that it may be harvested and cured during the dry season. Too much rain in the months of March and April will cause the tobacco to dry improperly, mould, and deteriorate in general.

Among the diseases and pests which affect tobacco are *salcocho*, or damping-off disease, tobacco mosaic, black shank, leaf spot, bacterial wilt, flea beetles, worms, and leaf miner. There are preventive measures for all of these except leaf spot, and this disease normally is not a vital problem in production.

Other factors which affect the production structure of tobacco are unscientific practices in farming and curing, labor supply and costs, and credit facilities.

Only a small segment of the tobacco farmers of the region has learned to appreciate the benefits of scientific agriculture. This group is composed of the more prosperous and better educated farmers. The remainder are *tradicionalistas* who oppose change and whose farming practices admit only a low quality of production. A crop as sensitive as tobacco is especially susceptible to primitive agricultural practices.

Among the more glaring malpractices are: (1) inadequate seed selection; (2) failure to protect seed bed with cheesecloth; (3) skimping on fertilizer both in the seed bed and in the field; (4) failure to remove the heavy growth of weeds which grows in the tobacco plots; (5) failure to prune the plant of lower leaves, terminal buds, and suckers; (6) harvesting of the crop before it has reached maturity; (7) use of inadequate equipment for drying the leaves; and (8) poor classification. All these factors detract from the quality of tobacco and reduce the price paid per pound.

Strange as it may seem in an area of overpopulation, the tobacco industry of the region is beset by problems of high cost labor and occasional labor shortage. This is due primarily to the minimum wage established for the sugar cane industry. Although not affecting the

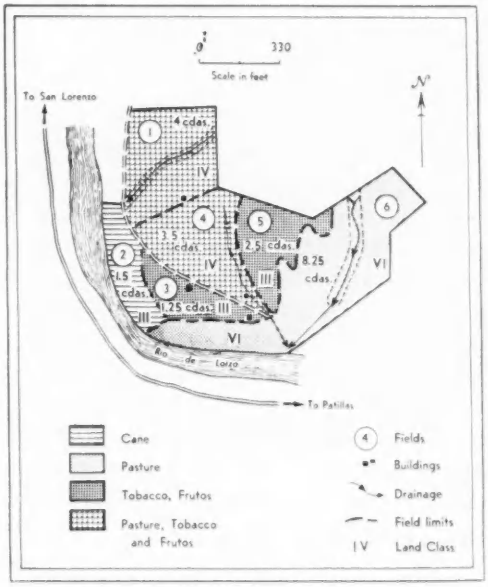

FIG. 4. Finca T. Rodriguez, a tobacco farm of the Eastern Highlands.

agricultural laborers in tobacco directly, the law has resulted in the rise of the laborer's wages in all branches of agriculture. Previously the worker on a tobacco farm worked for his meals and less than a dollar per day in wages. Since becoming accustomed to the high wages in the cane fields, he has refused to work in tobacco and other crops for less than $2.00 per day. The problem is that tobacco unlike sugar cannot support so high a wage scale.

It is true that for most farms the family supplies all the labor needs. However, it must be remembered that tobacco requires from 700 to 1000 man hours of labor per cuerda, and that in the highlands much of the younger population leaves for the city and for the United States. The older element left on the farm is often unable fully to exploit the land, and sometimes, rather than pay the high wages of hired labor, they leave the land in pasture.

Finally, credit facilities may play an important role in the production structure of tobacco. The amount of credit involved is less than that for sugar, but it affects many more people. More than 95 per cent of the tobacco farmers must borrow in order to bring in their crop. Living from hand to mouth, in debt for everything from food to fertilizer, the average tobacco farmer awaits the sale of his crop as an opportunity to square his debts temporarily before he begins to borrow again. Yet few manage to get out of the red before the borrowing cycle begins anew.

Numerous credit agencies cater to the needs of the tobacco farmer—the country general store, which grants credit for food and other necessities; the Tobacco Co-operative, which advances loans to members; the Production Credit Association; the Farmer's Home Administration; and the private *compradores* of tobacco. Interest rates on credit vary from a low of 5 per cent in the case of the federal agencies to 10 or more per cent for the private buyers.

CONCLUSION

Numerous factors affect the agriculture of the highland region in eastern Puerto Rico. Chief among these are: (1) an oversupply of labor and low labor productivity; (2) limited soil resources; (3) primitive agricultural practices; (4) monoculture emphasized by Puerto Rico's political relation to the United States; and (5) sharp socio-economic differences among the agricultural classes.

The influence of these factors is clearly brought out by a comparison of sugar cane and tobacco, the leading agricultural types of the region. Both types are affected by problems stemming from the labor force, monoculture, limited land, and primitive farming practices. However, there is a basic difference between the two in their relation to the American market. Sugar has the advantages of a secure market and federal subsidies. Tobacco has an uncertain market and no subsidies. Largely as a result of the market relation, cane is concentrated on the better lands; it is produced primarily by the wealthier farm group; it is displacing tobacco wherever physical conditions and transportation facilities permit.

PATTERN OF AIR SERVICE AVAILABILITY IN THE EASTERN HEMISPHERE

G. Etzel Pearcy and Lewis M. Alexander

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DURING the past three decades the air transportation industry has been moving forward at an ever-increasing rate. Advances in such fields as aircraft design, meteorology, and radar have combined to cut the risks and operating expenses of commercial aviation to a point where it can now more than hold its own against the established methods of surface travel. At the same time continued expansion of facilities has brought the benefits of air travel to millions of people who previously had had little or no contact with it. Today, regularly scheduled service is maintained throughout the year at approximately 2400 airports located across the face of the globe. As a result of the interconnecting services which the various airlines maintain with one another, these 2400 fields form one continuous air service network around the world.

About 52 per cent of these airfields are located in the Western Hemisphere and 48 per cent in the Eastern. The pattern of air service availability in the Western Hemisphere has been dealt with in a previous article.[1] On the accompanying maps the black circles represent all land areas within a 40-mile radius of a commercial field in the Eastern Hemisphere. The airport is generally accessible from all points within this 5000-square mile area, since even the farthest localities may be reached from the field in an hour or so by automobile or train. Exceptions occur, of course, where mountains, rivers, or other natural obstacles interrupt direct connections between the field and outlying areas. In such cases the travel time may prove to be well beyond 60 minutes. However, exceptions like these are actually few in number, and 40 miles has been chosen to represent the radius of availability.

Persons living within the darkened areas of the map may travel from their homes to any other point in the darkened section within a very short space of time. They may also journey to places within 40 miles of Western Hemisphere airports, since connections are maintained between the two land masses by 18 trans-Atlantic and 5 trans-Pacific airlines, offering a weekly total of over 130 flights in each direction.

One of the most interesting features of the map lies in the relationship between heavily populated areas and those with a large number of commercial fields. The concentrations of people in the river valleys of Southeast Asia, across the Chernozem Belt of Siberia, and along the coasts of Africa are clearly reflected by the many airfields in these regions. The same situation exists in the valleys of the Nile, the Yangtze, the Ganghes, and the Volga, while the wastes of the Sahara, Central Asia, and West Central Australia stand out as having little or no service whatsoever.

[1] G. Etzel Pearcy and Lewis M. Alexander: "Pattern of Commercial Air Service Availability in the Western Hemisphere," *Econ. Geog.*, Vol. 27, 1951, pp. 316–320.

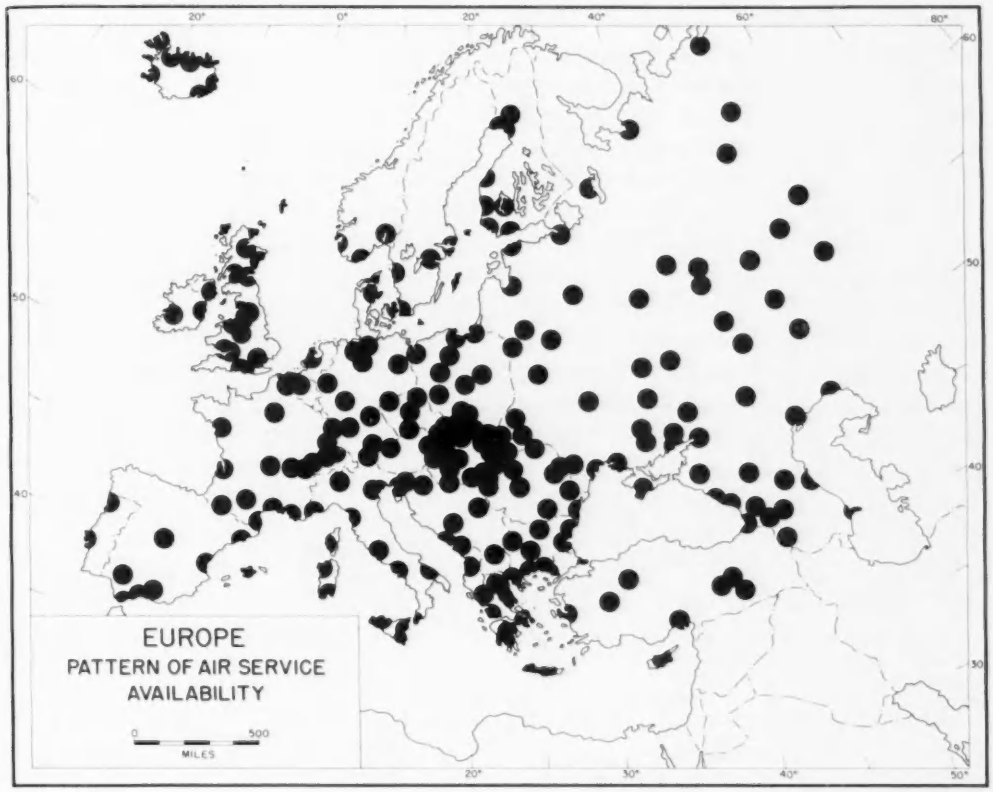

FIG. 1.

But the relationship is not always so direct. The crowded nations of Western Europe have 87 airfields to serve nearly 200 million people while the 40 million inhabitants of Central Africa have over 100. India and Pakistan together have 51 airports to serve their teeming millions, yet the island of Madagascar has 44 fields for its less than 5 million inhabitants.

Actually several factors are involved in determining the location of commercial fields. First is the ability of the region to support air service. That means that either enough people close to the airport are financially able to fly, or else the community must possess some special attraction which will draw air travelers. Examples of the latter type are the resorts of Blackpool and Nice and the shrine of Lourdes. Airlines are continually in competition with surface transportation facilities, and the development of transport patterns varies widely from place to place. In Eastern Australia for example the economy can support both an excellent rail and road network and a dense air system as well. Much of Western Europe, on the other hand, cannot afford both. Holland's KLM has abandoned service between Amsterdam and the provincial Dutch cities primarily because the people will utilize the country's extensive surface facilities rather than pay for the luxury of air travel. But in less developed areas where surface connections are poor airlines are often attracted by prospects of cargo revenues. Valuable low-bulk freight plays an important role in the economics of air operations, particularly where competition from other

carriers is almost non-existent. In regions where economic development is just beginning, one of the most expensive items is transportation, and air routes are far cheaper to set up and maintain than are railroads or highway systems. The dense air coverage in sections of Burma, Thailand, Ethiopia, and the Belgian Congo is in part a reflection upon the necessity of air travel since surface facilities here are extremely poor.

Since many of the companies are government controlled and subsidized, the profit motive is not always the only one to consider. Political and military factors may be involved, as well as national prestige. Why, for example, is there such a concentration of airports in Czechoslovakia, Hungary, and Rumania? It is doubtful that their economies really justify this development. Rather, the Communists appear to be strengthening their control over the satellite countries. The air networks of Mada-

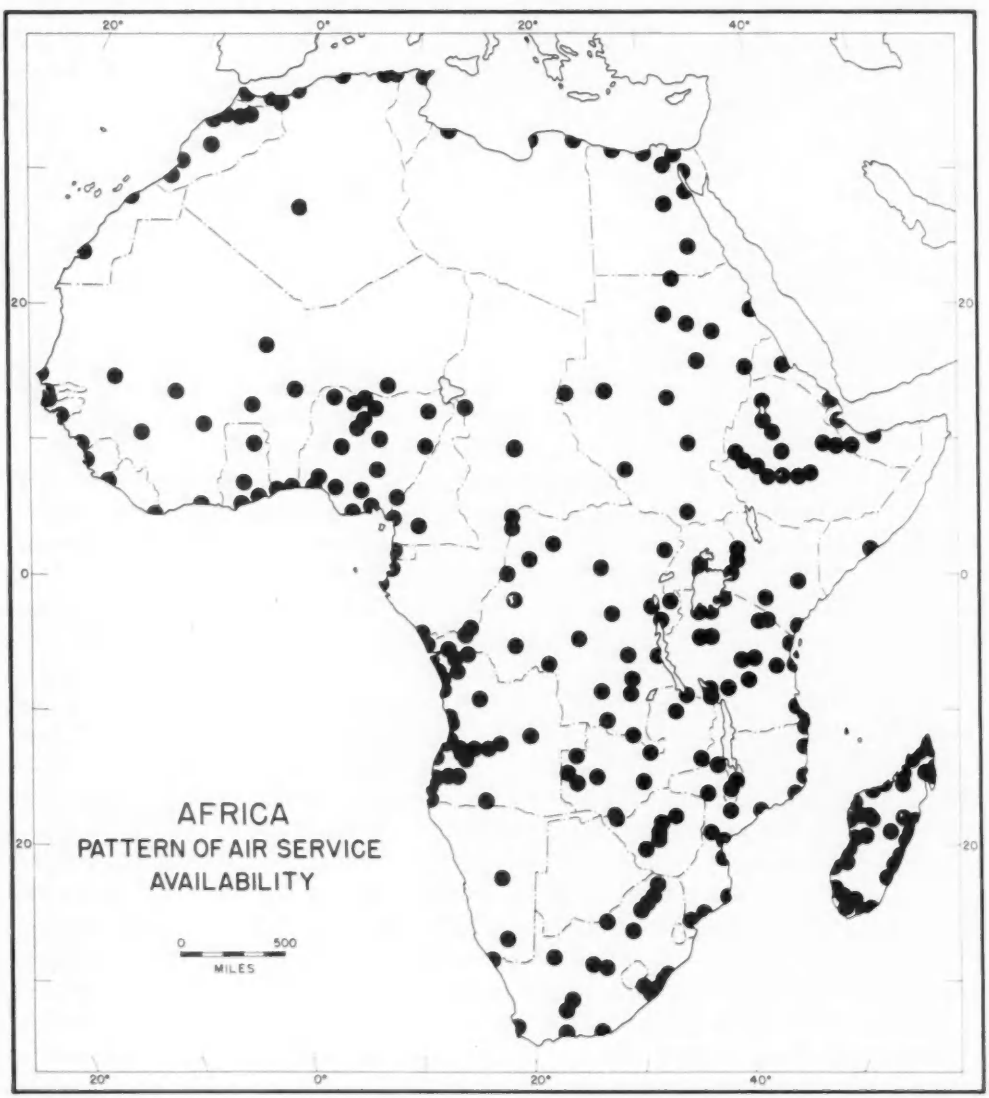

FIG. 2.

gascar, Nigeria, and Angola might also reflect political as well as economic conditions in those areas. Effective control in colonial regions can be maintained today only if fast, efficient communications are available between the capital and outlying sectors.

Of the continents, Asia (excluding the USSR) now has 298 commercial fields, Africa 292, Europe (also excluding the Soviet Union) 216, and Australia–New Zealand 165. Russia herself has 115 airports. Other leading countries include Madagascar, the Philippines, China, India, and the British Isles.

Such a commercial air net, although offering world-wide service to much of the earth's population, has certain limitations. Type and frequency of service will vary from one place to another. In parts of New Guinea connections are maintained by small flying boats on a daily, or even semi-weekly basis, while between London and Paris 17 flights are made daily in each direction, most of them by four-engined liners.

Economic conditions may be another drawback. For millions of underprivileged people the fact that an airport is located within 40 miles of their home is scarcely a guarantee of fast, efficient transportation to faraway places. Distant travel of any sort is, for many of them, completely impossible. Yet to thousands of others, air service is becoming a distinct reality with the extension of transport facilities and the introduction of low-cost travel

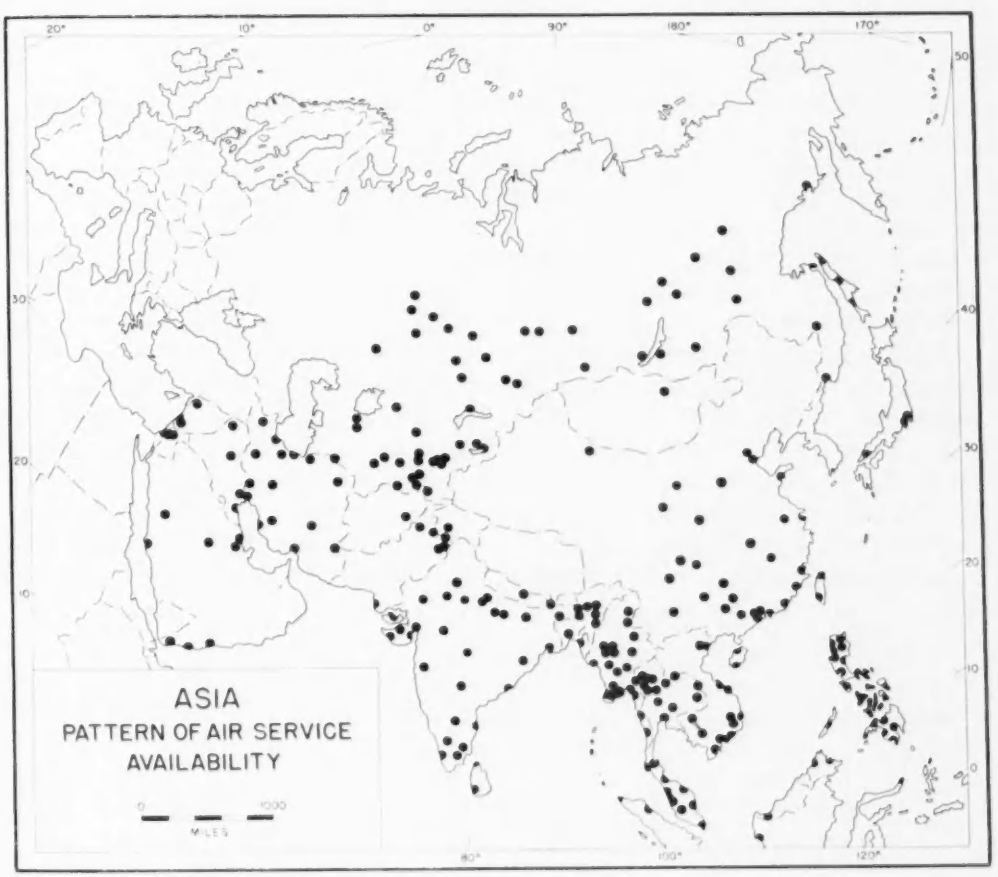

FIG. 3.

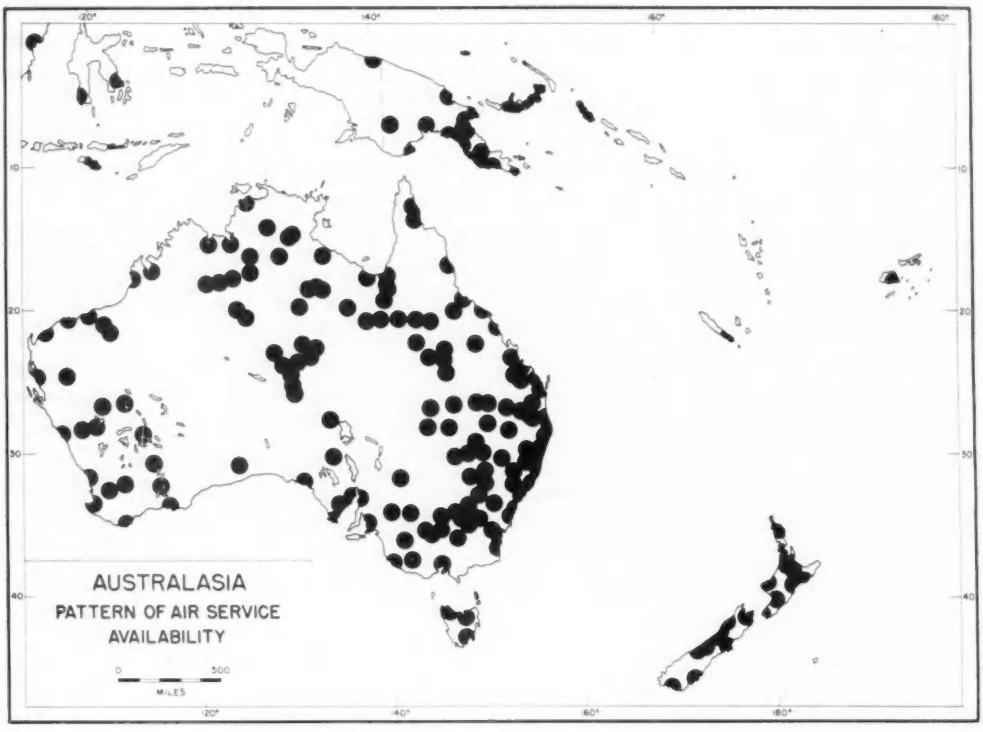

FIG. 4.

plans on many of the airlines. Superstitions are being rapidly swept away, and transportation for many has moved overnight from the Middle Ages to the twentieth century.

Finally there are the political barriers. Westerners are for the most part forbidden on airlines behind the Iron Curtain, while citizens of Communist-controlled nations are generally unable to travel to non-Communist areas. Several systems in eastern Europe still connect the two spheres, but close watch is kept on passengers who use these routes. Increase of political tension between East and West has led to the suspension of service at several points. Soviet influence in Afghanistan forced the recent closing of airfields in Herat and Kandahar to the planes of Iranian airlines, the country's only air contact outside the Communist orbit, while commercial flights to Seoul, Korea, and Langson, French Indo China, are prevented by actual fighting between Communist and non-Communist forces.

AN ANALYSIS OF POSTWAR INDUSTRIAL MIGRATION TO UTAH AND COLORADO

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IN the United States World War II greatly stimulated economic activity, increased industrial migration, and to some extent rearranged the country's pattern of industrial location. Since the end of the war the West and the South have become increasingly important as centers of manufacturing and commerce. Although data involving aggregate number and kind of new manufacturing enterprises are available for both the West and the South, in the West no comprehensive study has been made of the factors which motivated postwar location.[1] It was for this reason that the writer undertook a study of the forces orienting postwar industrial locations in the states of Colorado and Utah.

The two mountain states of Colorado and Utah have within their borders a land area larger than the combined area of the New England states plus the states of New York, New Jersey, Pennsylvania, Delaware, Maryland, and the District of Columbia. The total population of the two western states is smaller than the population of the state of Connecticut which has about 2.6 per cent of the land area of Utah and Colorado.[2] In the past the economies of both states have been centered around agriculture and the exploitation of mineral resources and the two states have played a relatively small role as centers of manufacturing. Thus, during the decade of the forties, both states together contributed less than six tenths of one per cent of the value added by manufacturing for the nation. The sparseness of population in the eight Rocky Mountain states and the distances to sizable markets outside the area have been important factors discouraging widespread industrialization. In addition, it has been charged that until recently the established freight rate structure and the basing point system of pricing have worked to the disadvantage of producers in the Rocky Mountain region. It has also been alleged that the conservativeness of western leaders has been an important influence which has had a deterring influence on new investment in these states.[3]

Most of the manufacturing in Colorado is carried on along the eastern slope of the Rockies. In 1947 over 75 per cent of the workers employed in manufacturing in Colorado found employment in the five counties of Arapahoe, Denver, El Paso, Pueblo, and Weld. In the state of Utah the major

[1] A study of location processes was made in the South in 1948 by G. E. McLaughlin and S. Robock, "Why Industry Moves South" (Kingsport Press, Inc., Kingsport, Tenn., 1949).

[2] Joint Committee on the Economic Report, "Handbook of Regional Statistics, 1950" (U. S. Gov't Printing Office, Washington, D. C., 1950), Chapter VII.

[3] Morris E. Garnsey, "America's New Frontier: The Mountain West" (New York, 1950), p. 4.

part of the state's manufacturing is found within the cities of Ogden, Salt Lake City, and Provo. In terms of wages paid out by the 17 most important industry groups in 1947, between 85 and 90 per cent of wages paid, were paid by firms located in these three urban areas.[4] Hence, given this industrial and geographical frame of reference, what kind of manufacturing enterprise would be most likely to choose Colorado and Utah as a base of operations?

In answer to this question, the location processes of 116 firms which initiated manufacturing operations in Colorado and Utah from January, 1946, through April, 1951, were analyzed on an individual basis. The major part of the data concerning location policies as evidenced by new industrial operations in Colorado and Utah was gathered by personal interviews with officials and owners of the firms. The new firms produce steel and steel products, refined copper, processed uranium, gypsum building materials, creosoted wood, petroleum products, salt, clothing, food and kindred products, machinery, glass bottles, furniture, magazines, chemical products, aluminum pistons, batteries, and many other products of a miscellaneous nature.

ORIENTING FACTORS OF LOCATION

Among the major economic forces which usually determine location, five have been attracting industry to Colorado and Utah since the war. Ranked in order of importance they are (1) markets, (2) materials, (3) labor, (4) available sites and plant facilities, and (5) climate. Certain other influences of a more secondary nature were also location determinants. Some plants were established in these two states for purposes of "decentralization." A few company officials were more than a little impressed by the "not too large yet not too small" cities on the eastern slope of the Colorado Rockies. Availability of power, fuel, and water played little part in location policies of firms analyzed. State laws in Colorado and Utah did not exert noticeable influence on location policies. It was observed by company officials that miscellaneous supplies and parts were hard to obtain in Colorado and secondly it was alleged that Colorado banks were ultraconservative.

The Influence of Markets

Of all the forces which attracted new industries to the states of Utah and Colorado in the postwar period, the greatest was that of markets. Although markets were not regarded as the prime reason for location by many new firms, yet, in nearly all new enterprises in these two states, the growth of the western market and its expected future growth was bound closely to entrepreneurial location decision. It would be difficult to overestimate the influence of this growth and the expected future growth of the western market as a determinant of industrial location policies of new firms.

The 63 firms which sell in the intermountain area employ about 12 per cent of the labor required by new firms noted in the study. The 18 firms which sell in the market consisting of the 11 western states employ approximately 61 per cent of all labor required by firms in the survey. The Geneva Steel Company and the steel fabricators in the Salt Lake City area together provide

[4] In the most heavily industrialized areas of Colorado and Utah an attempt was made to secure as complete a coverage of new manufacturers as available information would permit. It is the opinion of the writer that fully 90 per cent of all new manufacturing firms in Colorado and Utah employing 10 or more employees have been included in the study.

employment for about 45 per cent of all labor employed by firms in the study. Thirty-five firms, employing 27 per cent of all labor employed by the 116 firms, sell in a nation wide market.

In the past decade the population of the 11 western states has increased from 10.54 to 12.93 per cent of the nation's total population. The three Pacific Coast states with less than 10 per cent of the country's total population, contributed about a fourth of the entire increase in population in the nation.[5]

The share of aggregate national income payments of the 11 western states in the past ten years has increased from one-eighth to one-seventh of total income payments for the nation.[6] Consequently, the sizable increase in population and income payments in the intermountain and Pacific Coast states has made possible the initiation of new enterprise on a scale heretofore regarded as impossible because of the limited western market for manufactured products.

Approximately 40 per cent of all the new firms included in the study were firms in which markets were noted as the most important reason for location. These firms produce glass products, stokers, food and kindred products, batteries, furniture, brooms, clothes, machinery, petroleum products, steel products, building materials, chemicals, and electrical products. Many of these so-called market-oriented firms produce products which are bulky and heavy and difficult of transport or a product is produced which gains a considerable amount of weight in the process of manufacture. A location close to the point of sales minimizes costs.

Another factor which governed market-oriented locations was that of service to customers. For example, one lingerie company located a plant in the intermountain states to better serve the Pacific Coast market with rapid deliveries which permitted retailers on the Coast to maintain smaller inventories.

Although the "pull" of the western market has been the most important force directing postwar industrial location in Colorado and Utah, yet at the time the greatest immediate deterrent to greater industrialization in the West today is a lack of a market of the dimensions found in the eastern third of the country. In the eight intermountain states 3.3 per cent of the country's population live in 28.8 per cent of the country's area while approximately 75 per cent of the nation's population reside in the eastern third of the nation's area.[7] Officials of many of the new firms which began operation in Colorado and Utah postulated a continuing rapid growth of the western market. It seems unlikely, however, that the market potential of the intermountain and Pacific Coast states will continue to expand at the same rate as that maintained since the war.

The great distances of producing plants in Utah and Colorado from the country's largest markets and the adverse freight rate structure which has been in operation for western manufactured goods present barriers which new and potential enterprises are quick to recognize. New manufacturing establishments in Utah and Colorado which compete in a national market produce goods on which the transportation charge is not heavy or the product itself may be one which is practically alone in its field. It is in this fashion that new enterprises in Colorado and Utah

[5] The Econometric Institute, Inc., "Industry in Denver and the Denver Industrial Area," prepared for the United States National Bank of Denver, New York, 1950, Table IV–1.

[6] *Ibid.*, Table IV–1.

[7] Joint Committee on the Economic Report, Handbook of Regional Statistics, Chapter VII.

compete where the market for the goods is outside the 11 western states.

The Influence of Materials

The influence of materials as a factor governing location is most apparent in those industries which process raw materials or semi-finished products. Industrial orientation to materials occurs when a location oriented to materials presents an opportunity to minimize production costs. The cost affected is that of transportation. If a material is cheap, bulky, and loses a large portion of its weight or bulk in processing, it is customary to seek a location for processing near the source of the raw materials. The postwar years in Colorado and Utah have witnessed a noteworthy growth in industries where firms sought locations near their materials.

Although the mineral resources of Colorado and Utah have not exerted as potent an over-all influence on new industrial locations in the postwar period as has the market of the 11 western states, nevertheless as a long-run influence it is likely that the minerals of these two mountain states will strongly influence any large scale industrial development in Colorado and Utah in the future. It is impossible to isolate either markets or materials as influences governing location. Thus, the location of a firm may be oriented to materials yet at the same time the markets available will govern the initiation of operations. Without the Pacific Coast market it seems likely that Utah's postwar industrial expansion based on its minerals would have been negligible. Several of the largest firms which are oriented to minerals in Utah, market over 70 per cent of their products on the Pacific Coast. One large concern ships over 90 per cent of its finished products to the Coast. Presumably the Geneva Steel plant is oriented to the Utah minerals. Yet Benjamin F. Fairless, president of the United States Steel Corporation, said, "The constant growth of population and industrial activity in the Western States indicates a future for the Geneva Steel plant." The growth in the western market has permitted postwar operation of this huge steel producing unit.

Twenty-five of the firms in the study were oriented to materials. Of these firms, 16 were located in Utah, nine in Colorado. In the Utah group seven were attracted to raw materials and nine to processed materials. In Colorado, eight firms were oriented to the raw materials and one firm was attracted to partly-processed materials. The materials include iron ore, coal, gypsum, salt, petroleum, certain clays, steel, wood, and fruit.

Most of the minerals required in modern industry are found in varying quantities in Colorado and Utah. It is noteworthy that although over 200 different minerals have been reported in each of these states, at the present time fewer than 50 of them are being commercially exploited.[8]

Utah's postwar industrial development has been closely allied to the minerals of that state. The acquisition and successful operation of the government built Geneva Steel plant by the United States Steel Corporation was the most important step forward in the industrialization of the intermountain states in the years following the war. Important factors in locating steel producing plants are the costs of assembling the iron ore, coal, and limestone. The Geneva Steel Company's location was premised on the nearness to these three components which are all obtained in

[8] United States Department of Interior, *Minerals Year Book, 1948*, Washington, D. C., Chapters I and II.

the state of Utah. The Utah steel producing operation has given rise to a number of steel fabricating plants which have been attracted to the Provo produced steel. Thus, the Chicago Bridge and Iron Company and the Commercial Shearing and Stamping Company, two very large steel fabricating units, have located plants in the Salt Lake City area in order to minimize transport costs on their steel.

In Colorado, however, minerals of the state have played a small part as orienting influences for new industrial operations. Over 90 per cent of the labor force required by Utah firms included in the study finds employment in industries processing and manufacturing mineral products. By contrast, in Colorado less than 10 per cent of the labor employed by Colorado firms included in the study is employed in mineral processing or in the manufacture of mineral products.

It seems probable that if Colorado and Utah are to experience industrial development on a large scale the natural resources of the two states will be the orienting factors of location. Utilization of Utah's minerals in the last few years is illustrative of this. The exploitation of the vast deposits of Colorado oil shale would seem to offer the most promising possibility for a new heavy basic industry for this mountain state. Such an operation would bring with it many of the so-called secondary industries which would utilize the raw products produced. As market areas the states of Colorado and Utah along with the other intermountain states offer little encouragement for the development of large-scale industrial operations. As sources of minerals and other raw materials these two states provide a strong orienting influence for industrial location.

The Influence of Labor

In terms of number of firms initiating operations in Utah and Colorado during the postwar period, labor ranks a poor fourth as an orienting factor, falling behind markets, materials, and climate. In terms of number of workers employed, labor is the third most important orienting influence. Labor's influence upon industrial location was expressed through the medium of lower labor costs and allegations of less union activity. The companies attracted to Colorado and Utah by the factor labor produce electrical equipment, clothing, farm machinery, automobile equipment, and magazines.

Per capita wage payments in many industries in the Rocky Mountain area are considerably below the national average pay scale for those particular industries.[9] Among a number of new firms which located in Colorado and Utah in the postwar period, the feeling seemed to be that wages in these two states were somewhat lower than in many of the more heavily industrialized states. One official of a company recently moved to Colorado from the East said, "Take New York for example, the starting wage for a secretary there is $240 a month and increases with service. But in ———— the highest paid secretary in town gets only $175 a month." A number of comments in a similar vein were recorded in the study.

There is no doubt that alleged lower labor costs have been the motivating factor of location for some of the new firms in the state of Colorado. It would seem reasonable to suspect, however, that in the long run any wage differences in these states would be dissipated by a gradual influx of new firms.

[9] United States Department of Commerce, "Supplement to the Survey of Current Business, Regional Trends in the United States Economy," Washington, D. C., 1951, p. 51 and Appendix Tables 1 and 4.

Of the 112 firms analyzed as to unionization, 88 were not unionized while the employees of 24 firms were organized by labor unions. Eight of these 24 firms were Colorado establishments, 16 were located in Utah. Thus, 16 of 32 firms considered in Utah employed members of unions, eight of the 80 firms in the state of Colorado employed workers who were union members. If the Geneva Steel plant is considered as a separate category then, in the state of Utah, 15 plants employ 1903 nonunion workers while 16 plants employ a total of 1013 nonunion workers. In the state of Colorado eight firms employ 990 union workers while 72 firms employ 3491 nonunion employees.

Of the 13 new operations in the state of Colorado which employ more than 100 workers, only three have been unionized; the other five firms in Colorado which employ union workers are firms employing more than 25 workers but less than 100. All the firms in the state of Colorado which employ union labor are engaged in processing mineral products.

Of the 11 new operations in the state of Utah which employ more than 100 workers, eight have been unionized. Of the firms employing union labor in Utah, all but two are engaged in processing minerals or mineral products.

New industry in Utah has been closely bound to the mineral resources of that state. New industrial activity there has been confined almost entirely to the Provo, Salt Lake City, and Ogden areas. These three cities and their environs are located in a relatively small part of the state's area. The workers in the copper mines and other extractive industries of the state have long been unionized. The initiation of operations at Provo by United States Steel during the war years resulted in an expansion of union activity in an industry processing the state's minerals. Thus, the institutional and economic frame of reference in the state of Utah has been of such a nature that union programs have been operative under near optimum conditions for the successful organization of the workers. It would seem to follow that union programs would encounter less stringent opposition from enterprises which initiated operations in the postwar period in this area than they would in states where the conditions suggested above do not hold true.

In Colorado the industrial frame of reference as a background for union activity is somewhat different. The economy of the state is not linked as closely to mineral extractive industries as in the state of Utah. In addition, new enterprises of the postwar period in Colorado have not been so closely related to the minerals of the state as have new enterprises in Utah. The state of Colorado is not highly industrialized in the kind of enterprise which invites union organization. Thus, approximately 62 per cent of the nonagricultural labor force in the state is employed in trade, finance and allied activities, government service, and the field of services. Employment in mining, contract construction, and on interstate railroads totals a little less than 14 per cent of total estimated employment in all nonagricultural industries, while about 17 per cent of the nonagricultural labor is employed in manufacturing.[10]

Leaders of unions in the state allege that lack of more extensive unionization of Colorado industries is due to the type of industries which are found in the state and the tradition which has been fostered by nonunion enterprises and the agricultural and rural segments of the state's economy. In the smaller

[10] Colorado Development Council, Incorporated, "Report of Labor Supply and Training Facilities of State of Colorado," Denver, Colorado, 1950, p. 28.

cities of the state, union organizers may be able to organize a plant but the new members of the union find themselves in the minority in the community.

In addition, it is alleged by friends of unions that the government of the state is not noticeably friendly to organized labor. As evidence of the state government's attitude toward union activity and the labor groups of the state, it is noted that unemployment compensation and occupational disease laws are more lenient to the employer here than in the highly industrialized part of the country. The Colorado Labor Peace Act is regarded as being more restrictive of the employee in its intent than of the employer.

Thus, at the present time it is possible for a firm which requires a sizable labor force to initiate operations in the state of Colorado and maintain a nonunionized plant. The largest new firm to initiate production in the postwar period in the state of Colorado has not been organized by unions. The lack of union strength in the state has been a factor influencing location for a number of new establishments. An official of one of the largest postwar firms in Colorado commented that, "We are just like one big happy family here; we don't need or want unions."

The thesis is here advanced that for the present the institutional framework in Colorado presents a continuing orienting force for industries which may require the services of a large labor force and which are not bound to other locations by specific factors such as materials, markets, etc. In the absence of the establishment of new large heavy industry in the state, it is likely that the state of Colorado will continue to appeal to firms seeking a minimum of union interference.

The Influence of Available Sites and Plant Facilities

In terms of employment among the new Colorado firms included in the study, the two largest firms were Julius Hyman and Company of Denver and the Triplex Corporation of Pueblo. Both of these enterprises were located in Colorado because facilities were made available to them in former government installations.

Julius Hyman and Company, which specializes in the production of insecticidal chemicals, leases the Rocky Mountain Arsenal in Denver from the Federal Government. Had these facilities not been available this large chemical company would not have initiated operations in Colorado. One company official noted that, "It would be fair to say that the reason that the company selected Colorado for its operations was primarily the availability of these rather specialized facilities at a time when they were needed and under conditions which made it possible to commence production in a fairly rapid order."

The Triplex Corporation, the world's largest piston manufacturer, moved to Pueblo from Chicago in July, 1949. Productive operations were transferred to Pueblo because of the availability of buildings at the former army air base which had been leased by the city of Pueblo from the Federal Government for one dollar per year. The 154,000 square feet of floor space leased by the Triplex Corporation was acquired at what many people would regard as a very nominal figure.

In Utah the largest new enterprise, the Geneva Steel Corporation, was constructed by the Federal Government during the war and was acquired by the United States Steel Corporation from the Government in 1946. The acquisition price amounted to approxi-

mately 25 per cent of its original cost. It is likely that private enterprise would not have seen fit to construct a steel producing plant in Utah.

The Influence of Climate

Although climate ordinarily plays little part in industrial location, officials of approximately 25 per cent of all firms included in the survey stated that climate was for them the primary orienting factor of location. Climate was given a high place among the forces directing location for these firms, not because of its contribution to production, but because the owners who are also the operators of the 30 firms involved wished to live in the Rocky Mountain region. All 30 firms are located in Colorado, seventeen of them in Colorado Springs. The firms produce mattresses, building materials, furniture, clothing, machinery, stationery, chemicals, pottery, magazines, plastic products, electrical products, and miscellaneous equipment.

The state of Colorado was seen as a very desirable place to live from the standpoint of climate and also from the point of view of the region itself, i.e., clean cities, vacation and recreation areas, and pleasant geographical surroundings. In order to live in Colorado a number of entrepreneurs have incurred higher production costs and distribution in a smaller market area than that which accrued to them in prior locations. For example, the White Manufacturing Company of Colorado Springs which produces aluminum floral display racks moved to Colorado from Peoria, Illinois. Yet, approximately 90 per cent of the raw materials utilized and about 86 per cent of the company's markets are east of the Mississippi River. In addition, the Colorado location is disadvantageous because of the greater distance to conventions of funeral directors and florists which are generally held in eastern states. Thus, although the costs per unit of production are higher in Colorado Springs, the desirability of Colorado as a place to live was felt to warrant these heavier costs.

In a few instances the Colorado location has brought certain production advantages but these advantages were not anticipated when the location in the state was initiated. The Triplex Corporation which manufactures aluminum pistons finds that the low humidity in the area is advantageous for the casting of pistons. In production areas where the humidity is high the molten metal attracts moisture and the metal solidifies with gas pockets in it. It is estimated that in some cities in the Great Lakes area 70 per cent of the production of pistons is rejected because of gas pockets on days when the humidity is high. A few company officials have seen climatic conditions in Colorado as a factor in keeping the labor force cheerful and energetic.

With few exceptions the companies which located in the Colorado area because of the "pull" of climate are firms which are oriented to no one particular factor, i.e., the firms are "foot-loose." Thus, materials may be secured from sources all over the United States. The labor force required by any one of the firms is relatively small and hence may be readily secured from the city chosen for location. A number of these "foot-loose" enterprises were encouraged to locate in Colorado through chamber of commerce endeavor. Several owners commented that they might not have initiated operations had the cooperative activity of the local chamber been absent. No firm in this group employs more than 80 workers; the average is about 12 workers per firm.

The Influence of Promotional Effort on Location

No location was made in Colorado or Utah primarily because of community promotional effort although bonuses were paid to a few new concerns upon inception of operations. Company officials have been agreed that a bonus payment is viewed more as a token of community good will than as an important financial inducement. An official of a company which received a gift of $16,500 from a Colorado city for establishing a plant in that community and which has made wage payments of at least $850,000 over a period of five years said, "Actually, this donation to us by the people of ———— amounts to a very small proportion of our building costs and cost incurred during the first few months of plant operation. We regard this sum more as an expression of community feeling toward us. They must feel that we can do them some good and they apparently are willing to meet us half way."

Only five firms of the 116 in the study received gifts of money or property for locating in particular communities. These gifts ranged from a few thousand to a high of 37 thousand dollars which was paid one especially large enterprise for locating in Colorado.

Although community effort has not been the primary cause of location for any firm, yet it should be noted that in a number of cases initiation of operations would not have taken place without cooperation on the part of the community. The experience of cities in Colorado indicates that community endeavor is likely to be most fruitful when it is directed toward firms which are oriented to labor or to firms which are relatively "foot-loose" in their location policies. In addition, community effort has been of great value in acquainting firms which seek a new location with the location possibilities of a particular community.

The Influence of the Federal Government

Although local and state units of government have had a limited influence upon location decisions in Colorado and Utah, the influence of Federal Government policy upon industrial location in these two states has been enormous. The magnitude of this influence may be grasped if it is realized that 67 per cent of all labor employed by firms included in the survey was employed by firms whose locations were governed primarily or indirectly by past or present government decisions. If the Geneva Steel operations which dwarf all other operations in the study as to the number of workers employed is not included in the aggregate figures, then approximately 41 per cent of all labor employed by firms in the study is seen to be employed by firms whose locations were influenced by the Federal Government.

The influence of the Federal Government has been made manifest in a number of ways. The Geneva Steel plant was constructed during the war and began operations under government ownership in April, 1944. In June, 1946, a little over two years later, the United States Steel Corporation acquired the Geneva Steel plant at a price equal to about one fourth its initial cost. It is extremely unlikely that private initiative would have invested 200 million dollars in the Provo location although the United States Steel Corporation was not averse to acquiring the facilities at what Mr. Benjamin Fairless, President of the company, termed a "fair value." As a consequence of the Provo steel plant location a number of steel fabrication units have located in the Salt Lake City area.

The utilization of former army air base buildings and army arsenal facilities attracted some of the largest new concerns to Colorado, i.e., Julius Hyman and Company of Denver and the Triplex Corporation of Pueblo.

For some firms the government has provided a market for products produced. This is well illustrated by firms which process uranium ore. In addition, R. E. A. programs of rural electrification have made possible the initiation of operation by two creosoting plants in Colorado.

The use of gypsum products was popularized by use in government contracts during the war. It was this created demand for the products of gypsum which brought the two gypsum processing units in Sigurd, Utah, into operation.

Labor trained in governmentally operated plants during the past war was the orienting force for a few firms which sought locations in Colorado and Utah.

Thus, conscious and unconscious action and decision by the Federal Government has been responsible for much of the industrialization in Colorado and Utah in the postwar period. It is doubtful if many people are aware of the incidence of governmental decision for the development and industrial expansion of these two mountain states.

CONCLUSION

Two salient factors stand out in the postwar development in Colorado and Utah, namely, the importance for location of the growth of the western market in the 11 western states, and the direction given to industrial location policies by the Federal Government. Had either of these influences been absent, expansion of any consequence in the field of manufacturing in Colorado and Utah would not have taken place.

Industrial development in Utah has centered around the state's mineral resources. A market for the products produced was found on the Pacific Coast. Industrial expansion in Colorado has been more concerned with "foot-loose" firms which sought Colorado labor and available buildings and plant facilities. In addition, the state has attracted many owner-operated concerns because the owners wished to live in Colorado. Local and regional markets have attracted many small firms to Utah and Colorado. The chief deterrent to greater industrialization in these mountain states is the limited market available in the intermountain region along with the great distance to sizable market areas.

If the postwar period is indicative of the trend of future industrial growth in these two states, it would seem that private initiative and government policy should work hand in hand. The impetus given to Utah's extractive industries has been seen. It is likely that without Federal Government aid in the development of its mineral resources Colorado's industrial development will continue to center around "foot-loose" firms which are attracted by Colorado labor and such noneconomic reasons for location as the desirability of the state as a place to live.

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BOOK REVIEWS

Range Management: Principles and Practices, by A. W. Sampson. xiv and 570 pp.; maps, ills., charts, tables, index. John Wiley & Sons, Inc., New York, 1952. $7.50. 9 x 6 inches.

Were it not for the organization of this volume it would not be misleading to designate it an encyclopedia of range management. In the preface the author observes that "research knowledge is being made the vital foundation of improved range management practices. To continue this vital advancement we must have a progressively better trained research personnel." To assist in this enterprise the author has attempted "to incorporate in this volume all the more important range research advancements." It is clearly visualized primarily as a reference work, and will certainly be used by geographers in only that way. Dr. Sampson has probably had as much experience with range management work as anyone living in the United States today, and he is therefore peculiarly qualified to make this summary of present range-management knowledge, and to abstract those items most germane to range management from the supporting body of scientific knowledge in other fields.

The nearly 550 closely packed pages of text are organized into four major divisions. Part I is entitled "Range Management in Perspective," and is designed to furnish background material on the range livestock industry on a world-wide basis and the general approach to range management problems. The section ends with chapters on the "Physical and Vegetal Characteristics of United States Grazing Lands" and the "Historical Development of Grazing in America." Part II is a systematic botanical description and classification of "Native Range Forage Plants." Part III covers the whole field of "Improvement and Management of Range and Stock," and Part IV summarizes knowledge on "Protection of Land Resources and Range Livestock."

Subsumed under these four headings is an astonishing range of information. Are you interested in the taxonomic characteristics, nutritional value, and palatability for cattle of Galleta Grass (*Hilaria jamesii*)? The information is on page 173. The differences between a deferred grazing system and a rotation grazing system are clearly described on pages 268 to 272. A formula for computing the tonnages of haystacks may be found on page 328. Instructions in the laying out and use of quadrat field plots are found on pages 75 to 78, and the possibilities for expanding livestock production in New Zealand are briefly appraised on page 27. These illustrations should serve to indicate the comprehensiveness of the coverage.

It should be clear from the foregoing description that the volume constitutes an excellent shelf reference for any point related to the management of range lands. Moreover, the book contains abundant citations to primary research studies on each subject. A geographer whose work involves questions of range management or descriptions of grassland research methods will wish to have the volume available for reference. A chapter on "The World's Grazing Practices and Problems" may be of somewhat wider interest to economic geographers and regional specialists. The short chapter contains citations to thirty-nine primary sources.

Wesley Calef

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Pionniers et Planteurs de São Paulo, by Pierre Monbeig. 376 pp.; maps, illustrations. Libraire Armand Colin, Paris, 1952. 1500 fr. 10 x 6½ inches.

This is one of the most important books to be published this year. It is important not only because it provides a wealth of fact and interpretation concerning the occupance of São Paulo state in Brazil, but also because it sets a standard in the writing of a regional monograph which should be studied as an example of method.

Pierre Monbeig went to Brazil during the early '30s when the state government of São Paulo asked France for assistance in building up the staff of the University. He introduced into São Paulo not only the French instructional methods in university geography, but also the French interest in field research. The enthusiastic and capable group of geographers at São Paulo today are a tribute to the stimulating personality and the thorough professional competence of Pierre Monbeig. After World War II, Monbeig returned to France and now occupies the chair of geography at Strasbourg. This report on the planters and pioneer farmers of São Paulo, based on more than a decade of field

study and map analysis, is a doctoral dissertation. It received the prize in 1950 awarded for the outstanding dissertation at the *Fondation Nationale des Sciences Politiques.*

The theme is presented in the opening sentence of the introduction. The high rate of economic growth in São Paulo, which is the economic heart of Brazil, has received its strongest impulse from the development of new, previously unoccupied land. What kind of a land is this? Monbeig devotes three chapters to the natural conditions of relief, climate, soils, and natural vegetation. What kind of people have occupied this land? Monbeig devotes seven chapters to tracing the historical background of the pioneer movement. What is the status of the pioneer zone at the present time? Monbeig devotes six chapters to various aspects of the current picture—current, that is, up to the time of his departure from Brazil in 1948.

The material on São Paulo state brings together data from many scattered sources, interpreted in a masterful fashion by a scholar who has made himself thoroughly familiar with the details of an area through direct field observation. As usual, under these circumstances, an area often described in sweeping generalizations that imply homogeneity is found actually to be made up of contrasted parts—and these differences of detail are of critical importance in understanding the actual processes at work. In one of the concluding chapters Monbeig asks the question whether this is properly a region or a network—a distinction which this reviewer has described as a pattern of areas and a pattern of lines. The fact is that this, like most regions, is both: the movement of pioneers is along routes; the movement of products back and forth is along routes; the areas developed by the settlers are closely articulated to the roads and railroads; the settlers themselves are more conscious of attachment to a line of circulation than they are of their position in an area. The relative places of coffee, cotton maize, rice, beans, pasture, and other forms of use is carefully analyzed. But the effect is not a monotonous exposition of something that can be comprehended better from a map because the whole work is closely and carefully attached to the basic theme.

Only in one place can this reviewer comment without the fullest approval. It seems incredible that Monbeig should have followed Jose Setzer without reservation in the latter's remarkable claim that deforestation in São Paulo has produced a major modification of the regime of rainfall. From statistics of 1901–1912 compared with other data for the period after 1920, it appears that the dry season has been made drier and the rainy season rainier—at least this is the interpretation offered by the Brazilian scholar from Campinas. From the littoral, where there has been little clearing, the rainfall data show no such change. We can only insist (1) that rainfall data from observations which have never been carefully evaluated are of very dubious significance as a basis for studying long-term changes; and (2) that meteorologists would ask for some suggestion regarding the nature of the physical process that might connect rainfall and vegetation. The belief that forests produce rain has amazing stamina in the face of contrary evidence: but this goes much farther, for it claims that the cutting of the forests has produced a major change in the seasonal distribution of rain. Monbeig could not have been criticized for quoting this work of Setzer, but he might well have expressed some skepticism of its conclusions.

Monbeig's book is also of importance for geographers who have no direct interest in São Paulo. The French geographers have for many generations been known for their continued production of regional monographs—many of them dealing with parts of France, but some with foreign areas. This study of São Paulo should be examined in relation to the many regional monographs that have preceded it, and also in relation to the discussions of contemporary geographic method, especially of the regional concept.

The outstanding fact about Monbeig's method is his early statement of a theme and the strict exclusion of materials irrelevant to that theme. This is no encyclopedia. It does not attempt "to cover everything." Nor does it provide the detailed discussion of geology and geomorphology which has long been expected in such monographs. As a result the reader gains a new understanding of the processes of economic and social change at work in the region, and of the meaning of the resulting likenesses and differences. For the purpose of understanding the Paulista economy this book would be essential, not only for geographers, but also for economists, political scientists, or men of practical affairs. By continued study of the relevant aspects of a distinctive area over a period of years; by examining any processes that seem important whether or not they come traditionally under the purview of the geographers; by bringing all these unsystematically associated processes into perspective as they contribute to the character of this particular place—in other words, by the persistent study of a region in terms of a group of related topics—Monbeig has provided the geographic profession with an example of just how significant the regional concept can be, and how important can be the results of the proper application of regional method. To complete a job like this takes more than a summer vacation; it takes years of patient work, and it takes a fine development of geographic judgment. The result is a monument of which our profession can be justly proud.

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Nacionalizacion de las Minas de Bolivia, by RICARDO ANAYA. 353 pp.; tables, appendices, index. University of Cochabamba Press, Cochabamba, Bolivia, 1952. Bs. 300 ($1.50).

The Bolivian revolutionary government and the rank and file citizen momentarily are awaiting the recommendations of a committee appointed to study the feasibility of nationalizing properties of the country's three great mining interests—Patiño, Hochschild, and Aramayo. It would be difficult therefore to imagine a more appropriate time for the appearance of a book analyzing the political, social, and economic implications of a move which may create the economic transformation of this semi-colonial country.

Dr. Anaya, professor of public law in the University of Cochabamba, Secretary General of the P.I.R. (Party of the Leftist Revolution), and brilliant parliamentary leader, has divided his treatise into four overly-long chapters entitled: Characteristics of Imperialistic Penetration in Bolivia; The Actual Situation and the Need for Change; Nationalization of the Great Mining Interests; and Administration of the Nationalized Mines. In the first chapter grievances against past British and American economic policy toward Bolivia are presented. According to Dr. Anaya, the Bolivian government was required to deposit guarantees amounting to the total value of the loan advanced to construct lines of the Bolivian Railway Company, while the country paid an interest rate approaching 30 per cent and had little control over the location of the route. Moreover, the North American group organizing the venture had an initial financial investment in the railway totaling only US $3500. Considering mining revenue, it is pointed out that previous to World War II the Bolivian government received less than 10 per cent of its total annual revenue from taxes imposed on mineral exports; whereas this proportion rose sharply to over 50 per cent in the postwar period, a figure considered too great a burden on one industry. Dr. Anaya also includes in this chapter a treatment of the evils of monoproduction and an excellent analysis of Bolivia's ability to finance public works.

In the chapter dealing with the actual situation in the mines and the need for reform, the author is at his analytical best. Statistical tables indicate that lowering the cost of production, particularly by reducing wages and restricting social benefits, has not necessarily resulted in increased production as claimed in certain mining circles. Incidentally, concerning the cost of production and the most economical location for tin smelters, the devastating fact is that 65 per cent of the *refined* tin ore leaving Bolivia for British and American smelters is useless rock. Although social benefits have broadened in recent years due principally to greater organization on the part of labor, wages are still pitifully low even by Latin American standards. The majority of mine laborers (miners are the highest paid laboring group in the country) earn less than 55 US cents per eight-hour day at the present free rate of exchange. The health problem in the mines is acute; approximately 11 per cent of all miners 50 years of age and older suffer from silicosis or tuberculosis in their advanced stages. An analysis of mining profits indicates that the 25 year old Patiño mining enterprise in the seven-year period 1940 through 1946 earned in profit three times its capital investment plus US $2,500,000. Dr. Anaya concludes chapter two by emphasizing that one section of a nation's changing economy cannot be dealt with in an isolated fashion, that agrarian reform must necessarily accompany nationalization of the mining industry.

The author would exclude small and medium producers from expropriation procedure, as he points out in chapter three, but would have the state control the sale and export of all minerals, which actually has been the case since the April, 1952, revolution which brought to power Dr. Victor Paz Estenssoro, an advocate of nationalization although a political opponent of Anaya. The larger mining interests incorporated outside the country (represented by Patiño, Hochschild, and Aramayo) would be expropriated without indemnification for subsurface resources or the capital investment above ground, an attitude likely to provoke repercussions similar to those which enveloped the Mexican expropriation issue in 1938. In advocating expropriation of the yet unexploited subsurface riches without indemnification the author is standing on relatively solid legal ground, since Spanish law dating from the beginning of the colonial period in the Western Hemisphere does not defend private ownership of undevelopment mineral resources. His defense of expropriation of capital resources without indemnification is less convincing, and, indeed, it need not be defended too ardently because the large mining interests have rapidly amortized their machinery to the point where the government could probably afford to indemnify the corporations for their book value in dollars.

The last chapter of the book deals with the immediate and most pressing problems likely to confront COMINA (Corporacion Minera Nacional), the state-owned industry which would rise out of the hollow shafts of the nationalized properties. Dr. Anaya recognizes that these problems will be serious and readily admits that mistakes will be made, but feels that nationalization is both inevitable and necessary if Bolivia is to make cultural progress. Seven appendices contain readily digestible statistical

material concerning the financial position of each mining enterprise.

The North American reader may be somewhat irked by Dr. Anaya's embittered references to "el imperialismo yanqui," or, concerning the war in Korea, "los agresores Norteamericanos." These are not uncommon charges in foreign countries even in this hemisphere.

Most American investigators are accustomed to dealing with material documented in one, or at the most, two languages. In this book Dr. Anaya calls on English language sources, principally the reports of various United States and United Nations missions to Bolivia—Bohan, Magruder, Keenleyside—as well as sources in the Latin languages. Russian language sources include material pertinent to the subject drawn from a diametrically opposed economic philosophy, which might prove refreshing to the impartial investigator.

Apparently strong support favoring nationalization has evolved in Bolivia's man in the street and the revolutionary government he has brought to power.

FRANK LEUER KELLER

Santa Cruz, Bolivia

La Politique des États et leur Géographie, by JEAN GOTTMANN. xii and 228 pp. Librairie Armand Colin, Paris, 1952. 670 fr. 9 x 5¼ inches.

This is a short and lucid survey of some of the major topics of political geography, written with a skilled pen. The intended audience appears to be social scientists and informed laymen. Nevertheless, professional political geographers will find it rewarding and an English translation might serve at least as a supplementary textbook.

The first chapter develops the partitioning of the world into differentiated and organized political spaces as the central theme and warns that the stability of physical geography and the turbulence of history are both to be considered. The second chapter deals with the various doctrines of political geography. The development of French geographical thought is well presented. Germans, except for the Geopolitiker, and Americans, except for Bowman, are less well treated. There is no mention of the contributions of Whittlesey and Hartshorne, among Americans. Gottmann's preferred doctrine is a blend of possibilism and regionalism —a sound doctrine with the traditional French virtues of rationality and prudence. It may, however, be insufficient for dealing with the irrational and imprudent aspects of world politics. Power, and the striving for power, seem underemphasized.

The book continues with four chapters on major topics: territory, frontiers, population, and resources. The author treats each topic broadly. The Monroe Doctrine, for instance, follows a discussion of insular position in the chapter on territory. But Gottmann does not squeeze the Monroe Doctrine, or any other topic, into an environmentalist bed. He is fully aware of cultural and historical factors. On the other hand, he never throws out the baby of environment with the bathwater of environmentalism.

Gottmann's treatment of resources resembles Zimmermann's. This chapter is no mere inventory of currently known reserves. Rather, it is an examination of the changing needs for and supplies of resources as technology advances and the opportunities for international exchange wax or wane. The chapter makes no pretense of factual completeness. It is in effect an essay on resources in a changing world.

The seventh chapter takes up international organization, leading logically to the final chapter on the genesis and evolution of regionalisms. This final chapter contains Gottmann's principal theoretical contribution, a sketch of a general theory of political regions resulting from the interplay of systems of movement and systems of resistance to movement. Circulation is the principal system of movement, iconography (the summation of symbols of national or other group allegiance) of resistance to movement. Crossroads assume especial political importance, as foci of both circulation and iconography. These intriguing ideas are not fully worked out in this short chapter. One is left with a feeling that a word like iconography has somewhat the nature of a *deus ex machina*, a feeling that no doubt will disappear if this chapter is some day expanded into a treatise. One regrets that Gottmann made no attempt to relate his generalizations to those of Hartshorne's "The Functional Approach to Political Geography." The latter's centripetal and centrifugal forces should be related to Gottmann's systems of movement and resistance. Nevertheless, one feels that the merits of the book and its ideas far outweigh any defects, and that a translation (preferably with more documentation and an index) is heartily to be desired.

STEPHEN B. JONES

Yale University

Geography in the Making: The American Geographical Society 1851-1951, by JOHN KIRTLAND WRIGHT (Foreword by RICHARD UPJOHN LIGHT). xxi and 437 pp.; maps, ills., diagrs., bibliogr. notes, index. American Geographical Society, Broadway at 156th Street, New York, 1952. $5.00. 10 x 7 inches.

Dr. Wright, in writing this book, has rendered great service, not only to the American Geographical Society of which he is now the Historian after many years of directorship, but also

to American geography in general. Here is a well written, most complete document telling the life story of the Society for its first hundred years and with it the story of many men whose names have been familiar in American geography. A great part of the book is concerned with Isaiah Bowman and his inspired leadership. This is understandable because, in the eyes of the world, Bowman and the American Geographical Society long were synonymous.

The book is a big one, and, because it contains a great deal of material valuable only to the records of the Society, no one will sit down and read it from cover to cover. However, Dr. Wright brings life into the story and even in spots makes it exciting. Let me quote what he wrote about the day Bowman started his directorship: "Dr. Bowman once told me that there was hardly a morning when he failed to approach the Society's building with a sense of elation at the prospect of the day's adventures. He often spoke of being 'excited' by an idea or a good piece of work, and his ability to arouse excitement in his colleagues was a key to his success. His excitement on the morning of July 1, 1915, when he first entered the Society's door as Director, must have been at a high pitch. To him the institution seemed like a marvelous tool which a friendly Council had placed in his hands. The building was then new and bright—not cluttered, as it has since become. It had an air of spaciousness and dignity. Profound calm reigned in its uncrowded offices and halls. In cool and airy stacks some 47,000 fascinating volumes stood on the shelves, with ample room for twice as many more, and 36,000 equally fascinating maps did not nearly fill the handsome oak cases in the map room. No other geographer in the country had such material resources at his disposal or such an opportunity for increasing and improving them and making them 'dynamic'."

Dr. Wright has done a tremendous task amazingly well. The book will not be left on the shelves as a record, but will be taken off frequently to be browsed through as a story of a society and of men who made American geography famous.

S. VAN VALKENBURG

Clark University

Geography of the USSR—A Regional Survey, by THEODORE SHABAD. xxxii and 584 pp.; 57 maps, tables, bibliogr., index. Columbia University Press, New York, 1951. $8.50. 9½ x 6 inches.

The author's aim "is to make available to students, research workers, and others interested in the USSR an up-to-date treatment of the geography of that country." In his endeavor to achieve an up-to-date treatment, he has concentrated on the details rather than on principles. Consequently, the product is an encyclopedic work which by its very nature is dull reading and hardly suitable as a textbook. The greatest shortcoming in content is the treatment of people as statistics. Nonetheless, this volume is a useful addition to the factual literature on the USSR in English, and should be appreciated by those interested in the subject. Shabad has compiled assiduously a vast array of information—geographic, economic, and political—about the USSR. Much of this, culled from many sources, came in tiny bits and pieces, here put together as a source of reference in a rough but usable form.

The book is divided into two unequal parts. Part One—General Survey (92 pages) deals with The Physical Setting, The Political Framework, and The Economic Pattern. These titles convey appropriately the contents. Seven pairs of elementary maps, one each for the European and the other for the Asiatic parts of the USSR, accompany the text. It is a hurriedly written general survey—replete with place names, individual statistics, and dates—touching on many subjects but never pausing long to chew and digest. Much in the General Survey could have been written by an industrious journalist who can read Russian.

Part Two—Regional Survey (407 pages) is subdivided according to political administrative units into 16 republics, 13 autonomous republics, 124 oblasts, and 6 krays. This regional plan was "adapted from Soviet geographical works, principally the economic geography of [N.N.] Baranskiy," as "the only possible means of covering the entire country systematically and in great detail." Part Two deals with the physical and economic characteristics of the various regions, with "toponymy, changes in political administrative frameworks, localization of industry, details of construction projects, as well as thumbnail sketches of the principal cities." The text is complemented with 43 reference maps, "merely for locational purposes." In discussing the material means of production and the localization of economic activities the author uses a style resembling the official literature of the Five Year Plans.

A skillfully written preface, interesting and instructive notes on methodology and on the transliteration of Russian names, an appendix of statistical tables on areas, population, ethnic groups and cities, a well-chosen selected bibliography, and a 60-page gazetteer index complete the book.

With the research which Shabad has already done on the geography of the USSR, let us hope that he will now take the time to produce a college-level textbook on the economic geography of that country—a textbook in which the emphasis will be on the broad concepts, reinforced with maps designed for that purpose, and organized and written to bring maximum understanding with a minimum of words.

WILLIAM APPLEBAUM

Stop & Shop, Inc., Boston

Geography and the Location of Industry, by WILFRED SMITH. Inaugural Lecture as John Rankin Professor of Geography in the University of Liverpool. 20 pages. The University Press of Liverpool, 1952. 2 *s.* 8½ x 5½ inches.

It is no easy task to explain, within the scope of an inaugural lecture, the complex relationships between geography and the study of the location of industry, but Professor Smith has accomplished this in an excellent manner.

The author contends that economic geography, by virtue of its own tools—field survey, cartographical manipulation of data—makes its own fundamental analysis of these problems in which economists and economic historians have worked extensively. He first discusses the influence of the most general location factors—the location of raw materials, of industrial techniques, of markets—upon industry, illustrated by several British examples. Following this preliminary discussion a systematic arrangement of the problem is presented, with recognition of the particular economic and technical contexts of the location of industry. This again is formulated in terms of the present British economy.

In this study Professor Smith confines his attention to the regional location of industry and does not consider its local setting. Within the space of 20 pages he presents a very well balanced, lucidly written, and comprehensive survey of this important field of study.

WOUTER VAN DE BUNT

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NEW EDITIONS

Demographic Yearbook 1949–50. 558 pp.; tables, bibliogr. Second issue. (United Nations Publication Sales No.: 1951–XIII–1.) Distributed for United Nations by Columbia University Press, New York, 1950. $6.00. 11¾ x 9 inches.

Demographic Yearbook 1951. 608 pp.; tables, bibliogr. Third issue. (United Nations Publication Sales No.: 1952–XIII–1.) Distributed for United Nations by Columbia University Press, New York, 1951. $7.50 11¾ x 9 inches.

Economic Botany: A Textbook of Useful Plants and Plant Products, by ALBERT F. HILL. 2d edit. xii and 560 pp. McGraw-Hill Book Company, Inc., New York, 1952. $7.00. 9¼ x 6 inches.

Europe, by SAMUEL VAN VALKENBURG and COLBERT C. HELD. 2d edit. (First edition by Samuel Van Valkenburg and Ellsworth Huntington.) xiv and 826 pp.; maps, ills., bibliogr., index. John Wiley & Sons, Inc., New York, 1952. $7.50. 9 x 6 inches.

Geography of Europe, by GEORGE D. HUBBARD. 2d edit. xvii and 870 pp.; maps, ills., bibliogrs., index. Appleton-Century-Crofts, Inc., New York, 1952. $6.75. 9½ x 6 inches.